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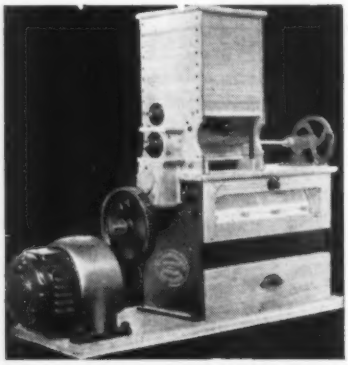

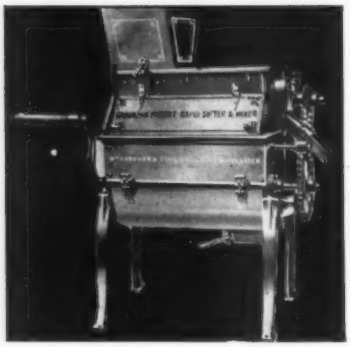

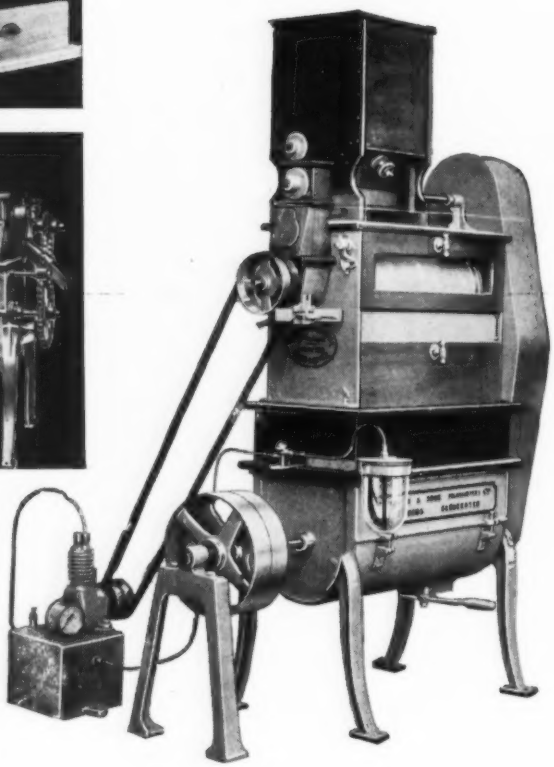

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FOOD MANUFACTURE

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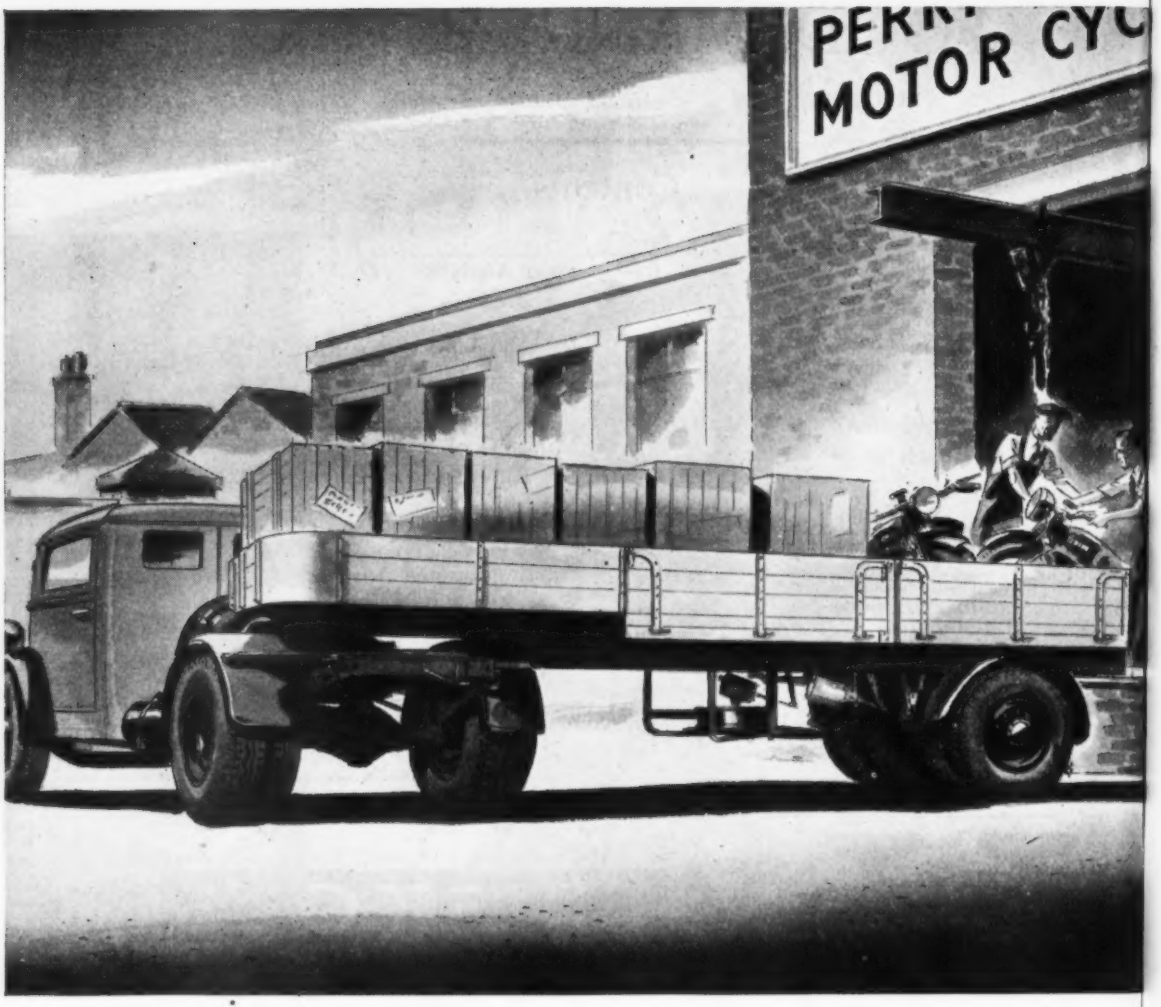

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FOOD MANUFACTURE

Vol. XVIII, No. 3 March 1, 1943

Bacon Curing in 1943

BEFORE the war only about 35 per cent. of the fat pigs produced in Great Britain were sold under the marketing scheme contract for manufacture into bacon. To-day more than 80 per cent. of the total output of fat pigs is sent to the curers. So great, however, has been the reduction in the pig population since 1939 that the major part of the 4-oz. bacon ration is supplied by Canada.

In spite of the concentration of the curing industry in this country, 77 per cent. of the total number of bacon pigs are travelling not more than 50 miles to the curer, and only 3½ per cent. make journeys in excess of 110 miles. Before the war the average distance travelled by baconers sold under the Pigs Marketing Board contract exceeded 100 miles. It is clear, therefore, that the Ministry of Food has effected a large economy not only in transport but also in food wastage, as the shrinkage loss has been similarly reduced. Moreover, these results have been achieved in spite of the closure of a large number of bacon factories.

The present policy of the Ministry of Food in encouraging the production of heavier pigs has set a problem for a number of curers. The pre-war baconer of 7 to 8 score pounds dead weight that was the pride of the Wiltshire style of curer finds no place in the wartime economy. The Ministry has just increased its payments by sums ranging from 22s. for a pig of 11 score 1 lb. to 42s. extra for a baconer of 14 score pounds dead weight. Thus a Wiltshire style curer can now produce nearly twice as much bacon per carcase as he did before the war; but he is faced with the problem of adapting to heavyweight pigs machinery that was designed primarily to handle the "luxury" lightweights of pre-war days.

Ice Cream's Last Hope

The Joint War Committee of the two ice cream associations is to make a last appeal to Lord Woolton to modify the Ice Cream (Prohibition and Sales) Order so as to permit manufacture for a limited period during the 1943 season. Manufacturers are strongly of opinion that if this appeal fails there can be no hope of production being allowed until after the war. Many leading manufacturers entertain little hope of any relaxation of the Order. The great need of 1943 is shipping, and the main ingredients of the wartime mix—wheat flour, sugar and fat—are all mostly imported.

It appears, however, that the Prohibition Order is by no means foolproof. Mr. F. J. Orth, a Past-President of the Ice Cream Association, asked the Ministry of Food for their ruling about the legality of a product that contained skim milk powder but no fat. Although there is no legal definition of ice cream, the pre-war "unwritten law" was that a customer who ordered ice cream was demanding a product that contained fat. The Prohibition Order does not attempt to define ice cream, but merely states that the term "includes water ices". Mr. Orth contends that the product he has described cannot be classified as ice cream because it contains no fat; nor is it a water ice because it contains milk solids.

Another question put to the Ministry is, If a fairly strong cup of cocoa be put through the freezer it will produce a palatable product. Is that product ice cream or is it still cocoa?

But the Ministry declined to answer the questions. The reply was that legality must be a matter for the courts. Manufacturers consider this answer to imply that the Ministry does not know the meaning of its own Order, and that traders who desire a ruling may obtain one through the courts at their own expense. So far no manufacturer has risked a test case with any product.

Colour in Bread

A Glasgow baker who had been testing the new blending of flour for the pan loaf stated recently that the reduction of the permitted quantity of white-flour content (from 25 to 12½ per cent. of total mixture) does not make any marked change in colour. If that expert view is accepted, it may be that the Scottish "batch" bread will not recover in favour to the extent hoped for by the baking trade.

The pan loaf had gained ground upon the common square (or batch) loaf because it appeared whiter, despite the fact that both had exactly the some dough mixture: one-quarter of white flour and three-quarters of National (or darker) flour. As the "batch" loaf is to retain one-fourth of white flour and the pan loaf is to have only one-eighth, the trade hopes that the common loaf will be enabled to return to its old popularity.

Such a recovery would substantially ease the man-power problem in the bakery. For example, the baker can produce 40 dozen batch loaves from a draw-plate oven, compared with only 18¾ dozen of pan loaves, which have to be baked in tins and all of which require handling. It is important that bakers should know that the 12½ per cent. margin of white flour applies to all bread other than the Scottish batch loaf, but that no white flour is permissible for cakes, biscuits, etc., except under special licence.

Rat and Mouse "Viruses"

Writing from the Bureau of Animal Population, Oxford University, Dr. P. H. Leslie, in an article published in the *Journal of Hygiene*, **24**, **5**, 552, has reported the results of his examination of six "viruses" which are at present used for rat and mouse control in Great Britain. (The word "virus" has been long applied to the bacterial preparations used in anti-rodent control, and the author has retained it, although it is now used with a particular meaning in medicine and bacteriology.)

Owing to the antigenic identity which has long been known to exist between many of the virus strains and *enteritidis* Gaertner, numerous warnings have been given by reputable authorities both in England and on the Continent of their potential danger to man, and the author cites the literature in some detail.

The author's findings were as follows:

1. By means of reciprocal absorption tests all the six strains were found to be serologically identical with *S. enteritidis* Gaertner, antigenic structure, IX : gom :—.

2. From the results of the fermentation tests, which may be used to subdivide this serological type, four of the strains were assigned to the var. *danysz* subgroup; while the two other strains could not be distinguished from the classic *S. enteritidis* type.

3. Both of these subgroups are pathogenic for man, and the evidence cited shows quite clearly that human cases of gastro-enteritis have been caused by the use of virus preparations. There are also reasonable grounds for believing that these bacterial types may be pathogenic for a number of domestic animals, including some poultry.

Moisture in Dried Vegetables

The determination of moisture in dried vegetables presents difficulties because many of them decompose rapidly when heated to 100° C. Vacuum drying at 70° C. gives satisfactory results, it is stated in an article in *Food Preservation Monthly*, issued by the Commonwealth Council for Scientific and Industrial Research (Australia). Thus all specifications for the moisture content of dried vegetables are based in the first instance on the figures obtained by drying the material to constant weight at 70° C. at a pressure corresponding to 100 mm. of mercury or less. Owing to wartime conditions the necessary equipment is difficult to obtain, and as a result of investigations, drying in air at 96° C. for sixteen hours has been adopted as the standard method in Australia.

The drying is carried out on the ground, unsieved, sample in tared tins of 3 to 3·5 inches diameter, the tins being provided with tightly fitting lids.

The figures obtained by this method are different from those obtained by the vacuum oven method, and separate sets of specifications are given for the two methods. For instance, the maximum permissible moisture of cabbage is 6 per cent. vacuum dried and 10 per cent. air dried. Potato seems to be the only vegetable which gives the same results for the two methods

Other Moisture Determinations

Investigations by E. G. Hallsworth and R. L. Reid (*Nature*, 1942, **150**, 524) of four methods for moisture determination in dehydrated vegetables show so little concordance in results that there is no alternative to the adoption of a specified method. The authors give results obtained by (*a*) Dean and Stark, toluene distillation (*Analyst*, 1920, **55**, 270); (*b*) vacuum oven at 70° C. and less than 50 mm. pressure; (*c*) hot-air oven at 115° C.; steam oven at 96° C. For carrots the respective results were 11·2, 5·45, 15·08, 8·52, and figures are given for cabbage and potatoes.

Method (*a*) gave no indication of reaching a constant value with carrots, onions or cabbages after thirteen hours' distillation, but with potatoes and parsnips gave a constant value fairly rapidly. Method (*b*) required five to eight hours with all the vegetables tested. Methods (*c*) and (*d*) required eight to sixteen hours for onions, parsnips and potatoes, but showed no approach to a constant value with carrots and cabbage. The standard error of the mean was lowest for method (*b*), higher for (*d*) and much higher for (*c*).

Starch-free Pea-nuts

A difference between almonds and pea-nuts hitherto relied upon to detect the presence of peanut flour in ground almonds resides in the fact that, whereas almonds contain no starch, appreciable quantities of starch are present in pea-nuts. Mr. G. Grinling, F.I.C., according to a note published in *The Analyst*, finds it possible to treat peanuts so as to destroy their starch content, the investigation having been undertaken because several nut preparations of unknown origin recently examined, while giving only a very slight iodine reaction for starch, were found to contain arachis oil.

Acid hydrolysis of pea-nuts was not found suitable, as discoloration was caused and the treated nuts developed an unpleasant taste. On the other hand, treatment with diastase yielded a starch-free product of good flavour entirely suited to the purposes of the food manufacturer. Two obvious applications of this discovery occur to us. The first is the utilisation of pea-nuts for nut preparations suitable for consumption by diabetics; the second, their employment for adulterating ground almonds. It becomes necessary for food analysts not to rely entirely upon the starch test, but also to test suspected ground almonds for arachis oil.

Foot and Mouth Disease

"Imagine the outcry that would take place if, when an epidemic, say, of scarlet fever or measles took place, all contacts were killed and incinerated." Thus *The Sanitarian*, in discussing the methods of dealing with foot and mouth disease which consist of the "indiscriminate slaughter of huge masses of animals, infected and uninfected alike".

Some light was thrown on this matter at a recent meeting of the Council of the Shropshire Chamber of Agriculture, when it was suggested that instead of the whole herd being slaughtered in the case of a very valuable herd, it should be isolated to give the animals a chance to recover and the hardier animals might even escape it. This method was said to be practised in the Argentine, and it was urged that the Chamber press the Ministry of Food to reconsider the matter.

Colonel Pollitt, the President of the Chamber, said that in the Argentine the disease could be compared with a cold in the head but in this country with double pneumonia. In his opinion, slaughter was the only way. Discrimination had been tried in Germany, but it had entirely failed. Even if a beast recovered from the disease, it would be in such a condition as to be of no value.

New Plant-Growth Substances

To those interested in the manufacture or the application of plant-growth substances, a recent paper published in America will be of value (*Contrib. Boyce-Thompson Institute*, 1942, **12**, 321). Workers at the Boyce-Thompson Institute have examined the action of a number of halogen substituted compounds as "plant hormones" and several new growth substances have been found and tested against known compounds. 2:4-dichlorophenoxy acetic acid and its derivatives were found to be most active, giving cell elongation in tomatoes when applied in concentrations as low as 0·0007 per cent. in lanolin. They therefore compare favourably with naphthalene-acetic acid, which has been discussed from time to time in these columns. Parachlorophenoxy-acetic acid was less active and the orthochloro compound less still. Bromine substituted compounds were less active than the corresponding chlorine substituted compounds. Of special interest from the theoretical aspect is the fact that 2-bromo-3-nitrobenzoic acid showed some growth activity down to 0·05 per cent. in lanolin and is the first example known of an active compound with the carboxyl group attached directly to the ring.

The new compounds vary in their capacity to induce adventitious roots, the para-chloro-, and the 2-4-dichlorophenoxy acetic acids and amides being the most active. Chlorophenoxy-acetic acid and bromonitrobenzoic acid differ from all other known chemicals, with the exception of β-naphthoxy compounds, which induce hormone-like responses in plants, in their capacity to cause formative effects on new organs or parts of organs to which the chemical has been applied. The dichlorophenoxy acetic acid at a concentration of 10-25 mg. per litre of water, when sprayed on open flowers of tomato plants, was highly effective for inducing seedless fruit. Additional research in this field should bring forth some new and interesting compounds in which halogens are substituted in the ring portion of the indole, naphthalene, anthracene and naphthoxy compounds already well known in this branch of work.

Nitrate and Nitrite in Meat Curing

Investigations are still being conducted in connection with the addition of nitrate as well as nitrite in the curing of meat, and it is suggested that there are several advantages accruing from the inclusion of nitrate, although it has no colouring action on the meat.

One contention is that if nitrate is excluded from the cure, there is a danger that the nitrite may be destroyed by bacterial action and there may remain insufficient to bring about the change of colour throughout the meat, and that it is therefore advisable to include nitrite to promote early colour development, and nitrate to provide a reservoir for nitrite.

It has also been stated that in addition to providing a reservoir for nitrite, nitrate has an important effect in increasing the rate of penetration into the meat fibres of water carrying the other curing agents and thus indirectly hastening the colour change due to nitrite, and that this applies equally to slow or quick cures.

With regard to the first suggestion, the use of nitrite alone is, under normal circumstances, sufficient for colouring purposes, and there is little or no danger of its complete decomposition during the cure. From published work carried out in the U.S.A. there seems little doubt that nitrate, even in small quantities, inhibits the action of putrefactive micro-organisms during meat curing, but again there should be little danger of this when the operation is carried out under proper conditions.

Evaporative Drying Systems

FRANK H. SLADE, A.M.I.Mech.E.

PERISHABLE foodstuffs such as animal or vegetable products may be kept in an edible condition by any one of three ways. Firstly, by extending the life cycle of the commodities by refrigerated storage; secondly, by canning; and, thirdly, by drying, or by evaporating the moisture from the product, leaving the edible solid.

The last process at the present moment is of paramount interest, for dried products have the virtue of keeping for considerable periods, occupy less storage space in their dried condition, and are more easily handled during distribution—three very important factors in wartime.

Drying

The purpose of drying is usually to establish a desired condition of moisture content and to regulate the physical properties of the material; therefore the term "drying" is applied when the final moisture content is lower than the initial moisture content. In practice the process of drying is either by mechanical means (such as filtration, settling, pressing or centrifuging) or by evaporation.

Drying by evaporation may be accomplished in any one or combination of the following methods:

1. Radiation.
2. Conduction or direct drying.
3. Convection.

Mechanism of Drying

Before delving too deeply into the methods by which drying of a material is carried out, it is best to consider two fundamentals:

How Dehydration saves Space. The same amount of vegetables (1) canned, (2) dehydrated.

4. The nature of the moisture in the solid.
5. The theory of drying.

The first of these fundamentals is extremely important in that it affects the commodity that is being dried. Moisture contained in the solid is in two forms. These are Capillary or Free, and Hygroscopic or Chemically Combined. Free moisture, as the name implies, is the term given to the moisture that is present in the capillary spaces between the fibre of the material. Removal of the moisture does not in any way change the state of the material being dried, other than change its weight, or its removal has a corresponding weight reduction only. On the other hand, the removal of chemically combined moisture changes both the physical and chemical state of the material being dried; this being due to the close association of the moisture with the physical properties of the material. The limit of the moisture so contained is called the "saturation point", and when the removal of moisture is carried on beyond this point there is a danger of a physical change such as shrinkage, hardening, etc., if due care is not exercised.

It can therefore be seen that the state to which drying is to proceed is dependent upon both temperature and humidity.

The theory of drying is mainly dependent upon the drying cycle of the material being processed, or the manner in which the moisture is absorbed from the material being processed.

During the commencement of drying, moisture is absorbed from the material being processed at such a rapid rate that water is apparent on its surface, and moisture exchange proceeds as from a free water surface; that is, the rate of evaporation from the surface is controlled by three factors:

6. The vapour tension of the water corresponding to its temperature.
7. The vapour tension of the moisture in the air corresponding to its absolute moisture content or dew point temperature.
8. The effective velocity of air over the surface.

This drying continues until the rate of evaporation is such that the moisture does not form a free water surface as fast as it is evaporated, or the "constant rate period" in the drying cycle reaches a point called the "critical moisture content". The "uniform falling rate period" is entered into at this point, or drying continues at a uniform rate with an unsaturated surface, when the surface of this material is absolutely dry; drying continues by evaporation of moisture from the interior, being absorbed from the surface as a vapour. This state is known as the "varying falling rate period", and continues until a state of equilibrium is reached in which the vapour pressure of the material and the vapour pressure of the air are equal, or drying ceases. This known fact is utilised to control the moisture content of the material at the end of the drying process—that is, control of the vapour pressure of the drying air affects a corresponding vapour pressure control in the material being dried.

Certain features are obvious from the foregoing and

have a definite bearing upon the application of the theory of drying. These are:

9. Care must be exercised if drying is carried below the saturation point of the commodity being dried.

10. Air motion is of vital importance in that the ratio of evaporation from a free water surface is dependent upon the velocity of air over the surface as well as the method of directing the movement upon it; in addition, there are such factors as the rate of air movement controlling the humidity of the leaving air, or the rate at which the surface of the material being dried is kept in contact with the drying air.

11. Temperature and humidity control of both the rate of drying and the final state of the dried article.

It is by considering factors 9 and 11 that the relationship of temperature, humidity and air motion to drying is understood.

Temperature, Humidity and Air Motion

Within a given range any particular design of driers can be adapted to suit various commodities. However, it must be observed that different commodities require different forms of treatment or, more precisely, varying conditions of temperature, humidity and air motion.

Considering the temperature of drying, it will be found that the higher the temperature, the higher the drying rate, this being because the higher the temperature of the air, the greater is its capacity for holding moisture. While the foregoing fact is conducive to rapid drying, the temperature of drying is nevertheless governed by the nature of the commodity being dried, the temperature being suited to the sensitiveness of the substance to heat, it having been found that some substances are prone to injury from high temperatures in both moist and dry conditions, are sensitive in a moist condition and not in a dry condition and *vice versa*. The temperature must therefore be regulated accordingly.

Efficient drying can also be effected by low drying temperature and low humidities, the low humidity increasing the capacity of the air for holding moisture; however, it is usually found more practicable to commence the drying period with a relatively high humidity in order to prevent hardening or drying of the outer surface of the material, decreasing the humidity as a state of equilibrium is reached.

The combination of the rate of air flow with the foregoing factors is very important in that the humid air from the drier must be removed at such a rate that the humidity must not attain a limit whereby drying is retarded. Alternatively, the rate should not be so rapid that the maximum moisture exchange properties of the air have not been employed.

Sufficient air spaces must be allowed around the material being dried, creating a free passage of air throughout the whole drying mass. The usual practice is to base the velocity of the air to suit a condition whereby the relative humidity of the air leaving the drier is approximately 75 per cent. Temperature and drying time for some of the better-known food products are shown in Table 1.

TABLE 1

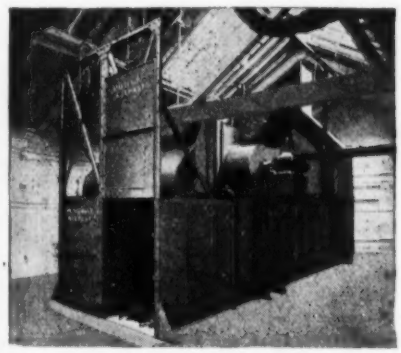
Material.	*Temperature (° F.).*	*Drying Time (Hours).*
Apples	140–180	6
Beans	140	18
Cereals	110–150	—
Fruit and vegetables ...	140	2 to 6
Milk and other liquid foods (spray-dried) ...	135–300	Instantaneous
Pears	140	24
Peas	150	6
Potatoes (sliced) ...	85	4
Potatoes (steamed) ...	170	6·4
Kippers	90–110	6 to 8

Methods of Drying

It has already been stated that drying by evaporation may be accomplished by three main methods—by radiation, conduction or convection.

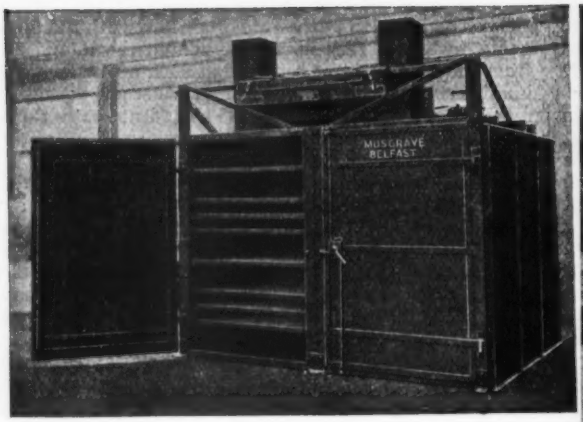
Radiation, as the name implies, is by radiation from a hot surface, such as a radiant heater or, when practicable, by the sun. This form of drying is assisted by air currents set up by convective heat, but generally speaking unless sun-drying is resorted to, such as in the drying of fruit, this form of drying is not usually adopted, due to the difficulty in obtaining a uniform drying rate.

Conduction is used in the drying of liquid foods when



A Double Tunnel Drier by Musgrave.

A Fruit and Vegetable Drying Room.



A Single Compartment Drier.

the liquids are sprayed upon a heated surface and there is no danger of injury through subjecting the product to the full temperature of the heated surface.

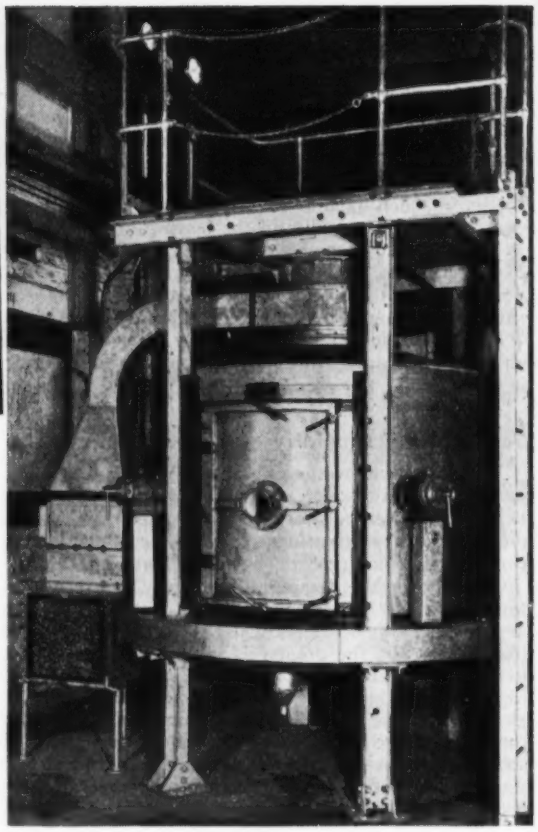
Drying by convection or air-drying offers the closest control and more uniform drying. Natural ventilation may be resorted to, or, more positively, forced circulation of air, obtaining a better distribution and positive removal of all moisture liberated.

The applications of this principle of drying are unlimited, and the materials dried are so numerous that many designs of air driers are available for this purpose.

Driers

The most generally used types of driers are the " Batch " or " Intermittent ", or the " Continuous ". Those for foodstuffs are divided as in Table 2.

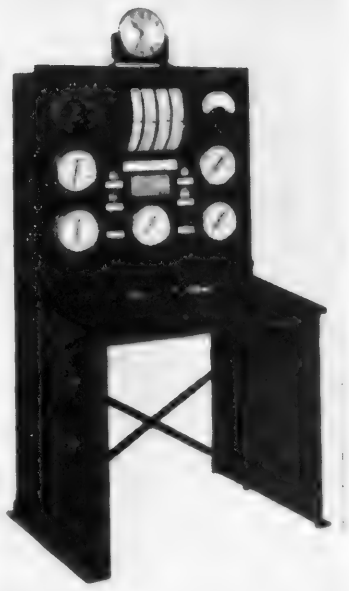
For many applications Compartment, Tunnel and Drum driers are utilised, compartment drying being



A complete Kestner Spray Drying installation sent abroad to South America recently, for drying fruit and vegetable powders.

TABLE 2

Type.	*Kind.*	*Means of Handling.*	*Temp. Range (° F.).*	*Heat Supply.*	*Use and Remarks.*
Batch or Intermittent	Compartment	Suspended, truck or tray	80–180	Steam coils, air or electricity	When production does not warrant continuous dryer
	Vacuum	Tray, basket or tumbling drum	80–300	Water or steam	Cost of operation high; for expensive materials
Continuous ...	Tunnel	Truck, tray or track	100–350	Steam coils, air or electricity. Products of combustion	For high production
	Drum	Flowed on drum Dry material scraped off	to 310	Steam	Hygroscopic. Dried with vacuum and packed immediately
Spray	Atomiser	Flowed or pumped to atomiser after distintegration to a cream	up to 300	Air	Dried and packed into metal containers



Instrument Panel and Control Desk for a large drying installation.

resorted to for small-scale production and close control. In the continuous driers the " green " products enter at one end termed the " green end " and leave at the other end—the " dry end "—in a dried condition. The product usually passes through the drier on a conveyor against the air flow, except when only a certain percentage of the moisture is to be removed; in this case it is often advantageous to reverse the direction of the air flow.

Liquid is either sprayed or dipped upon the heated drum of the drum drier, or the drum dips into the liquid to be dried, carrying up a certain portion in its revolution and drying it in its progress.

Liquids are also dried by spraying them into a current of warm air, evaporation being instantaneous, leaving a powder of uniform grade.

Spray Drying

Spray-drying, or the atomisation process, has become of paramount importance recently in connection with the preparation of fruits and vegetables for culinary purposes, more especially for the preparation of such things as soups. As already stressed, bulk storage must be considered in terms of food value and space occupied, and the larger this ratio, the better. Further to the question of space occupied, there is the method of storage to be considered—that is, the problem of packing the maximum value in the smallest container; this applies especially to metal containers.

The use of powdered products meets these requirements, the space occupied being in the order of one-tenth to one-twentieth of the unprocessed product.

Table 3 proves this fact by comparison between the water content of the unprocessed and the processed product.

TABLE 3

Vegetable.	*Water Content (Per Cent.).*	*Water Content of Dried Vegetable (Per Cent.).*
Beetroot	87	4
Cabbage	90	5
Carrot	87	7
Onion	87	7
Potato	75	8
Swede	89	4
Turnip	90	6
Celery	90	7½

This in terms of weight for three of the foods is shown in Table 4.

TABLE 4

Vegetable.	*Weight, Raw (Lbs.).*	*Weight, Dried and Packed (Lbs.).*
Beans	1,500	200
Potatoes	1,450	513
Cabbages ...	1,450	215

While the foregoing has been a known fact for many years, methods of processing and packing have not produced the results desired.

These results are preservation of food value, quality and colour without the addition of colouring matter; however, recent researches and developments have in

The Base on powder discharge of a large Kestner Spray Drier, which has been successfully used for producing plum and carrot powder.

spray-drying progressed to such a stage that the dry products produced retain their original character and food value.

The term "spray drying" means to dry a spray of liquid by means of hot air. This is carried out by means of an atomiser situated in a chamber producing a spray of liquid which is dried by hot air introduced through special distributors. The hot air meets the finely atomised product at the top of the chamber; instantaneous drying results, the resultant powder falling to the bottom of the chamber, and the air passes out to exhaust. This process for drying fruits and vegetables was patented in 1937.

The rapid exchange of heat in the process allows for high air temperatures to be utilised without deleterious effects to the product—namely, temperature up to 300° F. The resulting powder never exceeds a temperature of 120° F., and as it is continuously being removed from the drier, the period during which it is in contact with the heat is only a few seconds.

It can be readily understood that the benefits of this system are twofold, for not only is the quality of the product unimpaired, but the thermal efficiency of the process is high.

Preparation of Materials

The method of preparation of the vegetable to be processed is of some importance, for it must be reduced to a cream containing no solids or long fibres.

The process of preparation is, first, thoroughly to clean the vegetable, then to pass it through a specially designed machine that breaks up the solids and cellular structure and produces a smooth, free-flowing cream which can be fed through the drying plant, to be dried without difficulty.

The resultant powder is a mixture of the salts, complex components and insoluble matter, which have retained the original smell, flavour and vitamin content of the raw vegetable in a highly concentrated form.

This type of plant not only produces fruit and vegetable powder, but with very few adjustments will produce milk powder, egg powder, yeast powder and many other products at a very small cost and a high rate of production—namely, at an average figure of 1¾d. per lb., and for the smallest economical production unit about 2 cwt. of vegetable powder per twenty-four-hour day.

General Design

Other factors, apart from those already mentioned, are that uniformity of drying is essential; and for purposes of production speed of drying is essential, therefore the relative amount of exposed surface of the material to be dried is very important. Drying by spray is very rapid, and this is again due to the large area of exposed surface in proportion to the dried material.

Drying by convection is usually effected by indirect heating, but where there is no danger of injury to the product the material can be dried by direct exposure to the products of combustion. Some of the most important design features to be expected in a drier are as follows:

The temperature drop through the drier must be sufficient to cater for—

(*a*) The heat losses through the walls.

(*b*) Heat required to raise the temperature of the material being dried, and apparatus used as a conveyor through the drier.

(*c*) Heat required to evaporate the moisture in the material and to heat the air acting as a moisture carrier.

The rate of air movement or quantity of air to be delivered to the drier in a given time is dependent upon the moisture to be removed, and as the carrying capacity of the air is directly proportional to the difference in the wet- and dry-bulb temperature of the delivery air, it can be seen that the amount of moisture absorbed by the air is directly proportional to the difference in the dry-bulb temperature of delivery and exhaust air respectively.

A calculation of the quantities can be based upon the rule that the air temperature drop is approximately 8¼° F. per grain of water absorbed per cubic foot of air at 70° F., or 0·64° F./grain H_2O/lb. air. These factors are applied to "adiabatic driers" or driers in which the air is heated by indirect means.

Drying Processes

No hard-and-fast rule can be laid down about drying processes, because each particular product needs a different treatment, depending upon its biological and chemical composition, also its reaction to the drying process; but, to quote one example—the drying of kippers, which is a dual process of drying and smoking—the drying kiln is first warmed up to 70° to 80° F., the brined fish is hung on horses and placed in the kiln for approximately one hour, with no smoke in the kiln and the door of the kiln open and circulation fan in operation. This part of the process dries the outsides of the fish until they are sticky. The kiln door is then closed and smoke introduced, the fish being in this atmosphere for six to eight hours. The temperature of the inside of the kiln is maintained from 90° to 110° F., with a relative humidity of 50 per cent., and an air motion past the fish of one to five feet per second. The temperature of the fish throughout the process is approximately 75° F., with a temperature rise of approximately 45° F. from start to finish.

Conclusion

As can be seen, the combinations of methods of drying can be utilised to suit all types of products that satisfactorily respond to the treatment of drying. But it must be emphasised that satisfactory results can only be obtained by a close study of the response of the product to be processed and a close control of the three factors of drying—that is, Temperature, Humidity and Air Movement—if the maximum efficiency of processing and plant production is to be achieved.

British Material for Export

Overseas readers are advised that the fact that goods made of raw materials in short supply owing to war conditions are advertised in FOOD MANUFACTURE should not be taken as an indication that they are necessarily available for export.

Dairy Chemistry

PROGRESS IN 1941-42

The number of papers published on dairy chemistry has decreased during the last two years owing, no doubt, to diversion of attention to *ad hoc* problems of immediate importance and the necessary withholding of some work from publication. It is, however, gratifying to note that the papers published during these years of war have continued to embrace both fundamental studies and technological investigations. This brief review records the main features of a selection of the papers which appeared in 1941 and of those of 1942 which have already become accessible.

S. J. ROWLAND, B.Sc., Ph.D., A.I.C.

IN WARTIME, in cases of prosecution for the sale of adulterated milk, the defence may on occasion submit that the cows which produced the milk samples concerned had been subjected to air-raid shock. To elucidate this point, Rowland[1] examined milk samples taken from a large number of herds in various districts of Southern England for a period after bombs had fallen among or near the cows. No instances were encountered in which the bombing had affected either the fat or the solids-not-fat content of the milk produced. Arnaud[2] has since made an observation on the same subject. During August and September, 1940, the average composition of the milk produced in the Ashford and Ramsgate area, where many herds were bombed, compared very favourably with that of the milk from other parts of Kent, the fat being 3·64 and the solids-not-fat 8·69 per cent., as compared with fat 3·68 and solids-not-fat 8·75 per cent.

Influence of Mastitis on Milk Composition

With the realisation during recent years that subclinical mastitis, which is prevalent among dairy herds, may be associated with the production of milk with a reduced content of solids-not-fat, attention has been directed to the assessment of the extent to which this change of composition occurs, and to the changes in detailed milk constituents involved. Vanlandingham *et al.*[3] have investigated the relationship of the development of mastitis to changes in the chloride, lactose, and casein number of milk by noting the variations in the composition of the milk samples drawn from individual quarters of the same udder. Rowland,[4] in a discussion of the cause and significance of the variations in the non-fatty constituents of milk, has outlined an extensive study of the effect of both streptococcal and staphylococcal mastitis on the solids-not-fat, lactose, casein, soluble proteins, calcium, phosphorus, potassium, chloride, and *p*H of milk.

MILK CONSTITUENTS

Hilditch and his associates continue to make valuable contributions to our knowledge of the composition of milk fat. Following an examination[5] of the distribution of fatty acids among the component glycerides of a typical milk fat from cows at summer pasture, Hilditch and Jasperson[6] have studied the butterfat from cows fed solely on silage and hay in winter. The winter butterfat contained more myristic, palmitic and hexadecenoic acid, and less stearic and oleic acid, than the pasture fat. In general the composition of butterfat glycerides, with palmitic acid present in about 70 per cent. of the glyceride molecules, is similar to that of ox depot-fat, but with lower acids replacing some of the stearic acid. This supports the hypothesis that milk fat is the result of transformation in the mammary gland of pre-formed oleo-glycerides, including a large proportion of palmito-oleo-glycerides. Hilditch and Maddison[7] have studied the component acids of the phosphatides in butterfat.

Beck[8] has investigated the copper content of the milk of cows from normal and copper-deficient areas of Western Australia. The copper contents of the milks from the normal areas were mostly between 0·05 and 0·20 mg. per litre, while those from the copper-deficient areas ranged from 0·01 to 0·05, and averaged only 0·02 mg. per litre.

Dealing with the inhibition of lipase activity in raw milk, Tarassuk and Richardson[9] found that lipolysis does not take place while the milk is in the udder; the lipase is activated by cooling the milk to 20° C. or below. If milk is held at 32° to 33° C. for 1 to 3 hours after drawing, subsequent lipolysis is much retarded. Krukovsky and Herrington,[10] in further studies on lipase action, have dealt with the inactivation of milk lipase by heat, the effect of storage temperature upon lipolysis in butter, the effect of lipolysis upon the flavour score of milk, and the influence of the rate of cooling upon the subsequent rate of lipolysis of milk.

The Phosphatase Test

A large number of papers has appeared on the phosphatase test for the control of pasteurisation. Many contain little that is new; mostly the papers record the satisfactory use of the various modifications of the test,[11] or suggest minor modifications of technique. A critical review of the phosphatase test has been written by Burgwald,[12] and a brief review by Moloney.[13] A valuable study of some factors influencing the phosphatase reaction of flash-pasteurised cream and of butter made from it has been conducted by Wiley *et al.*[14]

Cream, pasteurised at a temperature of about 200° F. in a Vacreator, and giving a low phosphatase value, yields a butter giving an unexpectedly high phosphatase value in the serum. This is apparently due to the binding of a small proportion of the enzyme in the cream in such a way that it escapes destruction during the heat treatment, but is liberated when the butter is salted. The phosphatase test, therefore, cannot be used on the butter to indicate whether the cream has been properly pasteurised. The phosphatase test, as normally carried out, is not applicable to goat's milk, for the enzyme is inactivated sufficiently to pass the test when the milk has been heated for only 5 minutes at 143° F.[15]

The second phase of rennin coagulation—that is, the actual precipitation of calcium paracaseinate—has been studied by Berridge.[16] He has found that the relationship between the logarithm of the rate at which the reaction proceeds and the temperature is linear. The temperature coefficient of the reaction was 1·3 to 1·6 per degree C.; a high order which suggests that the second phase is a denaturation of the casein.

Noll and Supplee[17] have investigated the factors which influence the gas content of milk. The gas content of 63 samples of the mixed raw milk of a commercial depot was: oxygen 0·30 to 0·59, mean 0·47; nitrogen 0·18 to 1·63, mean 1·29; and carbon dioxide 3·44 to 6·28, mean 4·45 vols. per cent. Milk was deoxygenated by subjecting to vacuum treatment, flushing with other gases, or adding ascorbic acid and exposing to light.

MILK PRODUCTS

Wiley and Newman[18] have discussed the neutralisation of sour cream for butter-making. They give data to show the relationship between the titratable acidity and *p*H of raw cream, of neutralised pasteurised cream, and of buttermilk, and to show the relationship between the *p*H of butter and buttermilk and the cream from which they are made. The closeness with which one can hope to control the *p*H of butter by adjusting the titratable acidity of the cream is illustrated. Newman and Wiley[19] have continued the subject by discussing the factors influencing the accuracy of neutralisation.

English Cheese

Nicholls[20] has given a series of correlation tables and regression equations for the water and fat contents of several varieties of English cheese examined between 1933 and 1939. The mean percentages of water and of fat in the cheese, and of fat in the dry matter, in this order, were as follows for each variety, with the number of samples given last in brackets: Cheshire 40·53, 29·96, 50·30 (606); Cheddar 36·69, 31·82, 50·20 (363); Lancashire 44·28, 27·39, 49·10 (403); Stilton (white) 41·76, 32·44, 55·37 (124); Stilton (blue) 37·64, 35·71, 57·20 (212); Caerphilly 44·67, 28·43, 51·23 (234); Wensleydale 45·03, 27·72, 50·23 (111); Leicester 39·79, 30·21, 50·00 (24); Derby 39·95, 30·59, 50·7 (11); and cream 24·50, 71·60 (49). The following formula is deduced for application to cheese from milk or cream:

$$W + mF = \frac{100 - S}{100} K,$$

where W, F and S are the percentages of water, fat, and salt in the cheese, *m* is a factor dependent on the percentage of fat in the original milk, and K is a constant equal to 93·3 for cream cheese and 93·0 for pressed cheese. The paper gives details of the derivation of the formula and its use in estimating the percentage of fat in the original milk or cream. The factor *m* is regarded as a slightly better criterion than the percentage of fat in the dry matter of a cheese for determining whether the cheese was from whole milk.

Composition of American Cheddar

Marquardt and Yale[21] have given details of the water, fat, and salt contents of the Cheddar cheese exhibited at the 1940 and 1941 New York State Fairs, and of a number of Cheddar cheese selected over a wide area of the State. Dern and Dahlberg[22] have identified the white particles about the size of a small pin-head which form in and on the surface of the wrapping around canned Cheddar cheese as consisting almost entirely of tyrosine. In view of earlier evidence that the white particles found throughout the body and in the cracks of mature Cheddar cheese consist largely of calcium lactate, it appears that more than one type of particle is involved.

Davis[23] has given a general account of the significance and source of enzymes in cheese, and Hiscox[24] has discussed the development and measurement of the volatile acids of cheese and the differences in content and distribution of the volatile acids of various types of cheese.

Ash of Dried Skim Milk

The composition of the ash of dried skim milk and its relation to neutralisation have been studied by Hillig.[25] Sodium lactate and calcium lactate were added to a reconstituted unneutralised dried skim milk, and the effects on the alkalinity of the total and water-soluble ash and on the distribution of sodium and potassium between the water-soluble ash and water-insoluble ash were determined. When sodium lactate was added its alkalinity was only partly returned as alkalinity of the water-soluble ash, its sodium was found partly in the water-insoluble ash, and the proportion of potassium in the water-soluble ash had increased. When calcium lactate was added there was an unexpected increase in the alkalinity of the water-soluble ash, calcium having replaced most of the sodium and all of the potassium in the insoluble ash. The increase in the alkalinity of the water-soluble ash is therefore not a measure of added neutralisers, as unexplained base-exchanges take place.

Pure Salt for Dairy Purposes

The British Standards Institution[26] has issued a specification for pure vacuum salt for dairy purposes. The salt shall be white, give a clear colourless solution, contain not more than 0·20 and 4·0 per cent. of moisture in dried and undried salt respectively, and contain not less than 99·7 per cent. of NaCl on a moisture-free basis. Dried salt as packed shall pass completely through an 18-mesh British standard sieve. The following percentage limits of impurities are specified: alkalinity 0·03 as Na_2CO_3, matter insoluble in water 0·03, sulphate 0·10 as Na_2SO_4, iron 0·002, copper 0·0002, arsenic 0·0001, lead 0·0005; and calcium and magnesium shall conform to the tests prescribed. Methods of sampling and analysis are stipulated.

Menefee *et al*[27] have investigated the effect of the processing on the nitrogen distribution (total, protein,

casein, albumin, globulin, proteose, and non-protein nitrogen fractions determined by Rowland's procedure) of raw, pasteurised, homogenised, evaporated, cultured, and enzyme-treated.

DEFECTS OF MILK AND MILK PRODUCTS

Under this heading the various factors involved in the production of oxidative off-flavours in milk and its products have been the subject of most of the papers. These recent papers have been concerned mainly with the effect of the feed of the cow,[28, 29] and with the use of antioxidants; few have contributed to our understanding of the actual mechanism of the development of fat oxidation. The subject was extensively reviewed up to the beginning of 1940 by Brown and Thurston.[30]

Attention should be called to an excellent paper by Greenbank,[31] who has presented data obtained from the examination of over 4,000 samples of milk from about 300 cows under the following headings: the detection of milk samples susceptible to off-flavour development, the cause of variation in the susceptibility of individual milks, the promotion and inhibition of oxidised flavour by variations in the oxidation-reduction potential, and the effect of metals, feeds, storage temperature, heating, bacterial growth, air, light, antioxidants, and variations in ascorbic acid content.

Garrett[32] has investigated the interrelation of various metals and their salts on the development of oxidised flavour, with particular reference to the inhibiting effect of manganese. Manganese greatly retarded, or completely prevented, the development of the flavour in milk containing ferrous iron or copper, and in milk which was spontaneously susceptible. Sharp *et al.*[33] have described important preliminary work on the deaeration of market milk as a means of retarding the development of oxidised flavour and the destruction of ascorbic acid.

Work on Antioxidants

The trial of cereal flours and their extracts as antioxidants in milk and dairy products, and in milk cartons and butter wrappings, has continued.[34, 35, 36]

Dahle and Nelson[37] have attempted to isolate the active antioxidant fractions of oat and soya-bean flour. Corbett and Tracy[38] found that the addition of 0·02 to 0·04 per cent. of tyrosine and its esters to milk, and of one part of pancreatic extract to 25,000 parts of milk, prevented the development of copper-induced oxidised flavour. Waite[39] has investigated the use of several concentrations of oat flour and hydroquinone to delay the development of tallowy flavour in milk powder. The addition of 0·1 per cent. of oat flour to the original milk was ineffective, but 0·25 per cent. added to the milk or 2·5 per cent. to the powder delayed the onset of tallowiness, but not of cardboard flavour, by the equivalent of four months' normal storage. Hydroquinone proved completely effective, but is excluded on account of metallic flavours and legal objection.

Hollender and Tracy[40] have investigated the effect of several antioxidants on milk powder; and the effect of variations in pasteurisation temperature, moisture content, type of container, and storage temperature. The greatest antioxidant effect was shown by gum guaiac (5 p.p.m. in the liquid milk), followed by hydroquinone (10 p.p.m.), ascorbic acid (0·01 per cent.), and sodium citrate (0·20 per cent.).

ANALYSIS OF MILK AND MILK PRODUCTS

A comprehensive review of the literature on the Babcock test for fat has been written by Herreid.[41] Gould[42] has investigated the influence of rancidity in milk upon the accuracy of the fat determination by the Mojonnier method. In milk in which the extent of lipolysis was much greater than would normally be encountered the analytical results were very slightly low. Starr and Herrington[43] made Mojonnier tests on butterfat containing an admixture of fatty acids resembling hydrolysed butterfat, and found that only about one-quarter of the fatty acid mixture was extracted. When single fatty acids were added to butterfat the proportion of acid extracted increased with increasing molecular weight of the acid.

Determination of Lactose

A valuable paper on the various procedures in use for the determination of lactose in milk has been contributed by McDowell.[44] The values for the lactose content of milk determined by the direct volumetric copper reduction method applied to unclarified milk and to clarified decalcified milk by the polarimetric and iodometric methods applied to zinc hydroxide or cadmium hydroxide filtrates, and by the chloramine-T method applied to dialysed iron, phosphotungstic acid, cadmium hydroxide or zinc hydroxide filtrates, showed close agreement and may therefore be accepted as the true values. Clarification with acid mercuric nitrate or phosphotungstic acid for the polarimetric method, and with dialysed iron or phosphotungstic acid for the iodometric method, gave high results owing to failure to remove interfering substances. Sharp and Doob[45] have evolved a method for the quantitative determination of α and β lactose separately.

The recovery of citric acid by the usual modifications of the pentabromoacetone methods tends to be incomplete; Deysher and Holm[46] have shown that the loss of citric acid may be due to incomplete conversion of the acid, due to too short a period of reaction, the volatility of the pentabromoacetone during drying, and its solubility in the reaction mixture and wash water. A standardised procedure is recommended which gave results within $\pm$0·50 and $\pm$1·0 per cent. when applied to pure citric acid solutions and decitrated milk plus citric acid respectively.

An interesting method for the determination of dissolved oxygen in milk has been devised by Sharp *et al.*[47] based on the complete reaction of the oxygen with reduced ascorbic acid in 5 to 15 minutes at 25° C. in the presence of cucumber ascorbic acid oxidase. Ascorbic acid is added to the milk and determined by titration with 2 : 6-dichlorophenolindophenol before and after treatment with the oxidase. The method was used to check the efficiency of a commercial milk deaerator.

Butterfat Values

A semi-micro method for the determination of Reichert, Polenske, and Kirschner values of butterfat has been evolved by Dyer *et al.*[48] It deals with 1 gm. of fat: approximate results are obtainable with 0·25 gm. Approximately one-fifth of the usual quantities of reagents is used, and the apparatus is reduced in size accordingly. Twenty-one ml. of distillate are collected in 5 to 7 minutes, and of this 20 ml. are titrated. When

compared with the results obtained by the standard method, which requires 5 gm. of fat, Reichert values showed good agreement, Polenske values were a little low, and Kirschner values somewhat high.

Ogg *et al.*[49] have described a micro method which is useful for the study of the distribution of salt in butter. An approximately 0·2 mg. sample of butter is picked from the bulk with a dissection needle and transferred to a platinum micro-spoon. It is then weighed and ashed, and the salt is titrated with 0·01 N. silver nitrate solution.

Full experimental details of the development and use of their extraction method for the determination of the volatile acids of cheese have been given by Hiscox *et al.*[50] Marquardt and Dahlberg,[51] on the other hand, now favour for this purpose a slight modification of the well-known direct steam distillation of a cheese mush.

Quality of Skim Milk

Hillig[52] has given a useful series of data illustrating the significance of the determination of the lactic acid content and the alkalinity of the total ash of dried skim milk as an indication of the quality and possible neutralisation of the initial fluid skim milk. He also gives full details of his colorimetric method for the determination of lactic acid based on the extraction of the acid with ether and the production of a colour with ferric chloride.

Swope[53] has given full details of the Pennsylvania method, using standard Babcock equipment and an ammonia-butyl alcohol-sulphuric acid reagent, for the determination of the fat content of ice cream, condensed and evaporated milk, dried whole milk, milk, cream, buttermilk, and cheese. The results agree well with those of the Mojonnier method.

Harmon and Renner[54] have described a simple vacuum total solids tester which can be assembled from ordinary laboratory equipment, and Schroeder and Racicot[55] a method for the detection of sodium alginate in dairy products.

For a review of the progress of dairy chemistry from 1939 onwards, and from 1937 to 1939, the reader is referred to Rowland and Scott Blair.[56, 57]

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The Factory Canteen

The number of factory canteens has multiplied fivefold since 1940. Many firms with more than 250 employees are required by law to provide canteens ; many more have found that it pays to do so. Below answers are given to fifteen leading questions asked by employers in industry who are contemplating installing canteens.

1. *What's behind this canteen business? Surely this isn't the time to spend money on welfare work.*

The movement for establishing canteens in places of work is not a sinister plot by Mr. Ernest Bevin for the encouragement of the pampering of the working class. It springs from the Government's deliberately considered food policy, and its purpose is to see that the war-machine's human prime movers are properly stoked with the right fuel.

Physiological considerations apart, it is obvious that, after enough food has been distributed to keep the Forces fighting-fit, and the whole population working-fit, workers have a better claim to any surplus than have non-workers, and that workers in essential industries can put the additional calories to better use than workers in dispensable trades. Any attempt to give effect to these differential claims through the national rationing scheme would have resulted in impossibly cumbrous machinery and perhaps friction. The Government has adopted the simpler alternative of supplementing industrial workers' diet through canteens and the British Restaurants.

The aim of the Ministry of Food is that workers engaged in war production should take at least one main meal a day while at their work, and without giving up coupons.

It is probably not necessary to insist today that the provision of feeding facilities in the factory is an aid to production and not a piece of tax-subsidised philanthropy. It has been abundantly proved that the rest-pause for light refreshments acts as a stimulant to the flagging production graph, and that these mid-shift breaks do in fact result in higher output.

The need for organising feeding facilities becomes, of course, the more necessary today because of the extension of working hours and the employment of thousands of women unused to factory discipline.

2. *Is the canteen movement succeeding?*

The astonishingly good showing made by British health statistics in the third year of war is perhaps the best answer, but the figures of meals served are also impressive. The last estimate of the number of factory canteens is about 7,500—probably five times the number in 1940. The figures of meals served are not classified in a manner enabling them to be extracted for canteens proper, because as far as the Ministry of Food is concerned canteens are merely one part of a grand scheme of workers' feeding which makes use of many agencies.

The Ministry of Food divides factory canteens and other catering establishments feeding industrial workers into two groups. The first group (category A) includes canteens and, in exceptional circumstances, other catering establishments serving workers in twelve heavy industries. These number 3,310 and are estimated to serve 13,811,000 meals per week.

The second group (category B) includes all other works canteens and commercial catering establishments 60% of whose patrons are factory or industrial workers. These establishments number 9,811 and serve a total of 27,019,000 meals per week.

Other catering establishments (numbering 101,716) supply 94,878,000 meals per week.

Of this total of 135,708,000 meals, it is estimated that 43,931,000 are "main meals," 34,877,000 "subsidiary meals," 8,494,000 breakfasts, and 48,406,000 teas.

Thus one can compute that something like 7,000,000 workers eat at least one meal a day in canteens or catering establishments, and are provided with food supplementary to their rations.

3. *Am I compelled to provide canteen facilities?*

You *can* be compelled to put in a canteen if you are the occupier of any factory in which (to quote the Factories [Canteens] Order, 1940) "more than 250 persons are employed and in which is carried on the manufacture or repair of any munitions of war or of any materials, parts or tools required for such manufacture or repair, or any work on behalf of the Crown."

The obligation to provide a canteen is conditional on being directed to do so by the Minister of Labour, acting through the Chief Inspector of Factories.

The extent to which the Ministry of Labour makes use of its powers to compel a company to instal a canteen depends, of course, on a great many factors, such as the nature of the work carried on, the adequacy or otherwise of local feeding facilities, and the degree of urgency of the need for a canteen in relation to the need for canteen facilities in other localities, all of which must be supplied with equipment and staff from limited resources. Obviously, the Ministry prefers that firms shall put in canteen facilities voluntarily, from a conviction of their utility in stimulating production.

4. *What is it going to cost?*

It is difficult to answer this question even by a rough indication owing to the variation in the type and size of canteen and consequently the kind of equipment which would be necessary—not to speak of changes in the price of equipment caused by fluctuations in the supply of materials.

About a year ago a rough-and-ready basis of calculation for a canteen establishment under pretty well ideal conditions was £10 per head for building costs and £5 for equipment. Prices are certainly higher today. On the other hand, many firms are able to convert a part of their premises at a much lower cost.

5. *That's going to work out pretty expensively. I suppose there are Government grants, though?*

You suppose wrongly, sir. No Government grants are obtainable for the establishment of factory canteens.

E.P.T.? Yes, there is hope of relief from that direction. If you will take up the matter with your local Inland Revenue authorities the possibility will be explored by a friendly official.

The Chancellor of the Exchequer explained the situation in the House of Commons on January 28, 1941. Sir Kingsley Wood said: "Where capital expenditure has been incurred by reason of the war in the provision of canteens, it will rank for relief from Excess Profits Tax under the provisions of Rule 3 of Part I of the Seventh Schedule, Finance (No. 2) Act, 1939, and I intend to include in the next Budget, as a wartime measure, proposals for the allowance of similar relief for the purposes of Income Tax and National Defence Contribution. I would add that all revenue expenses incurred by a trader in the maintenance of canteens for the use of his employees are admissible as a deduction in computing his trading profits for taxation purposes."

The proposals for the allowance of relief mentioned by the Chancellor are dealt with in Section 19, Finance Act, 1941. The Inland Revenue authorities will be able to give particulars of this section.

6. *Can I "farm out" the canteen to a contractor?*

Commercial organisations specialising in works-catering do exist, and by drawing on their experience the employer can save himself much trouble. But it is necessary to qualify this by saying that if the employer looks on the service of a contractor as a convenient way of getting shot of all his obligations he will be disappointed. Industrial canteens have increased so greatly since the war that commercial caterers have for the most part been forced to concentrate on operation.

When building materials, equipment and labour were plentiful, the service a contractor was able to offer was worth many times his reward. He could choose what he believed to be the best of many alternative types and makes of equipment; he could select the most efficient of the reasonably adequate supply of skilled labour and of the sufficient supply of unskilled and semi-skilled labour offering itself for employment. Today the supplies of equipment, labour and building materials are all closely controlled by Government departments, and the scope of the contractor for exercising his judgment in selection is correspondingly narrowed. Nevertheless, the caterer can give most useful advice on the equipment most suitable for the size and special requirements of the canteen, and he is skilful in preparing a lay-out which will minimise unnecessary movement and labour.

The other important reason why an employer should not attempt to shift the whole burden on to the contractor's shoulders is that he cannot afford, in the interests of maximum production and good relations with the work-people, to escape his responsibility of seeing that they are well fed. Even when the operation of the canteen is undertaken by a contractor the workpeople ought not to be allowed to get the impression that a profit-making concern stands between them and the management, or that their own suggestions and criticisms will be judged by a profit-and-loss standard.

On the other hand, it is not envisaged by the Factories (Canteens) Order that employers should subsidise meals for workers. It may be that some manufacturers will wish to provide below-cost meals for some classes of workers, such as juniors; or it may be that the employer wishes to provide a canteen for his work-people even though their numbers are too few really to warrant a canteen. The experience and practical knowledge of the caterer can help the employer to calculate precisely the amount of the subsidy and keep it within bounds.

With the reservations just made, an employer should certainly investigate the service a contractor is able to give. Catering is a business in itself, with problems and difficulties best understood by people who follow it, and a badly-run canteen can waste a lot of money and executive time and energy which would be better directed to production.

These contractors have within the last month or so formed the National Society of Caterers to Industry (83, Pall Mall, London, S.W.1; Whitehall 3955). The twenty members of the society at the time of writing are responsible for operating more than 1,000 industrial canteens serving some 2,000,000 hot meals daily.

Arrangements made by the caterers and their clients vary, but the most usual is for the caterer to enter into a contract to provide specified meals and refreshments at an agreed scale of prices, and otherwise operating as an ordinary catering establishment. Under such an arrangement the caterer would apply for registration of the canteen as a catering establishment, but the canteen's grading for the purpose of food allocations would not be that of an ordinary catering establishment, but a grading appropriate to the type of worker employed at the factory.

Any variation of this arrangement with the caterer is possible, from operation on a fee basis to the provision of purely advisory or supervisory service.

In any case, however, the employer will be required to provide the building in which the canteen is to be housed, and the larger "capital" equipment. In many cases he may also have the responsibility for engaging the labour. Small equipment, such as cutlery and crockery, is usually supplied by the caterer, and this is no small advantage to the employer in view of the shortage of supplies.

Reverting to the National Society of Caterers to Industry, it is worth while to explain the purposes for which it has been formed and the activities on which it has embarked. Its origin is to be found in the obvious desirability of providing Government departments concerned to deal with a single representative body with which to deal instead of a great many separate firms, but the firms who have joined it look forward to the Society's becoming a medium for improving canteen practice and developing the factory canteen as a permanent part of industrial life after the war. The Society and the trade unions have set up a joint industrial council to regulate wages and conditions of work. One sub-committee of the Society is dealing with the question of training skilled labour and another is collaborating with the Ministry of Works and the Ministry of Supply in the wartime standardisation of equipment.

7. *What sort of meals should my canteen provide?*

While the employer will be content to leave the actual planning of menus to the canteen manager and cook, he will want to satisfy himself that the food is as nutritious and appetising as can be provided, and he will therefore wish to familiarise himself with the best canteen practice and nutritional advice. There is no lack of such advice. The Ministry of Food recommends that every effort should be made to serve *each day*:

(*a*) ½ of a pint of milk per head, as a minimum.
(*b*) Wholemeal bread and oatmeal.
(*c*) Some raw food, either vegetable salad or fruit.
(*d*) A serving of cooked green vegetables or carrots.
(*e*) A large helping of potato.

The canteen should also do its best to provide *each week*:

(*a*) One dish of herring or other fat fish.
(*b*) One liver dish.
(*c*) One cheese dish.

The first course and the milk drink are nutritionally the most important. The value of the sweet course lies largely in its energy content and its palatability. If supply difficulties make it impossible to serve a sweet there are alternatives. Either serve a second course such as wholemeal bread sandwiches, or increase the quantities of potatoes and vegetables in the first course, or precede it with a thick vegetable soup.

To provide nutritionally balanced meals in wartime the canteen must serve foods and dishes which may be strange to the canteen's customers. These should be introduced gradually, even unobtrusively. Don't outrage the dietetic conservatism of the British working man and lass by advertising the raw vegetable content of some dishes, or insist too emphatically on the vitamin value of strange foods. There is much merit in fancy names which are not too informative.

There are several useful publications giving tested specimen meals. Specimen menus, with prices, adopted by several industrial canteens, including that of Boots Pure Drug Co., Ltd., are given in " Canteens at Work," by C. G. Gardiner (Oxford University Press, London, 1941, p. 64; price 4s. 6d.).

8. *How much space will be needed?*

In view of the limitations on new building construction and the likelihood that an employer will want to put in the canteen without delay, it is realised that many wartime canteens will not be ideal from the point of view of spaciousness and layout. It is desirable, of course, that the site shall be central, removed from the sight, noise and vibration of the workshops, and, at the same time, so placed and so ventilated that cooking fumes don't invade the works.

Any calculation of size of canteen must start with an estimate of the number of employees who will use it. According to " Canteens in Industry " (Industrial Welfare Society, London, 2s. 6d.), a 1939 survey showed a variation of 10% to 100% from factory to factory in the use made of the canteen, while the percentage taking full meals ranged from 2 to 45. Longer hours and the employment of housewives in industry have tended to increase these percentages, but a 1942 check-up showed that it is still rare for two-thirds or more of the employees to take their mid-day meal in the canteen.

In forming an estimate of the number of workpeople who will use the canteen, through the means of the welfare officer or works committee, allowance should be made for the possibility of expansion of the labour-force and changes in its composition due to dilution with women labour and part-time workers.

" Canteens at Work," the publication already quoted, suggests the following area for dining-rooms, kitchens, storerooms and subsidiary accommodation for canteens of various sizes:

No. of Diners.	*Sq. Ft.*
100	600
250	1,500
500	3,000
1,000	5,000
1,500	6,000

In the dining-room at least 8 sq. ft. should be allowed per person where tables are provided and 6 sq. ft. with benches.

The area needed will, of course, also vary with the method of service adopted—*i.e.*, by hatch, counter or waitress.

9. *What method of service is to be recommended?*

Waitress service is the exception, owing to shortage of suitable labour. The practice of retaining waitresses for staff canteens seems to be a class distinction without wartime justification.

Hatches connecting the serving-room with the dining-room, and at which the diner collects his own food, are the simplest, but may lead to queues and confusion if most of the workers eat at the same time. Counter or cafeteria service enables the food to be displayed and prevents congestion, but if guide-rails are used to marshal the traffic, with trays for collection at the entrance, many workpeople will dislike the system. They rationalise their dislike by complaining that their second course gets cold while they are eating the first, but one might guess that the real objection is to the mechanisation of the process of eating. Having spent one's working hours under the discipline of the conveyor belt, it is perhaps natural to resent too much " Taylorism " at mealtime.

Actually, counter service is very flexible, and it is possible to find a combination of counter display of cold foods, thermostatically controlled hot cupboards, and broken queue-rails to enable single dishes to be collected, and separate tea and coffee bar, which would be an efficient compromise.

10. *How do I set about getting equipment?*

There is little point in giving a list of catering equipment that will be needed, first because this can be obtained either from a catering contractor working in an advisory capacity, or from the Factory Canteen Advisers attached to the Factory Inspectors' offices in sixteen regions. The equipment is also described in detail in several publications, including " Canteens in Industry " and " Canteens at Work " (p. 91). But the second reason for refraining from going into this matter in too great detail here is that a radical rationalisation of the design of this equipment has been carried out by the Ministry of Works and Planning and the Ministry of Supply, so as to make possible flow production. The less useful sizes have been cut out, all unnecessary refinements have been or are being scrapped, and standardised forms of construction have been specified. These specifications have been published and should be studied by firms contemplating installing a canteen.

Until the programme of production based on these new standards is in full operation supplies of equipment are as difficult to get as most other machinery, but application to the District Inspector of Factories for certificates of release of equipment, whether heavy or light, should speed-up delivery.

A point stressed by the Ministry of Labour's Factory Department, dealing with canteens, is that forethought should be given to the provision of an alternative form

of fuel against the chance that the local power supply might fail in an air attack.

11. *What labour will be needed to staff my canteen, and how should I engage it?*

The Ministry of Labour's Factory Department has supplied us with some helpful suggestions under this head, but stresses the point that they are only suggestions.

Catering staff required.	*Number of workpeople to be fed.*				
	100	250	500	800	1,000
Manageress	—	1	1	1	1
Assistant manageress	—	—	1	1	1
Cook-manageress ..	1	—	—	—	—
Head cook	—	1	1	1	1
Pastry cook	—	—	1	1	1
Assistant cook ..	1	1	1	1	2
Vegetable cook ..	1	1	1	2	2
General assistants ..	1	2-3	5	8	10
Storekeeper	—	—	1	1	1
Cashier	—	—	—	1	1
Service hands ..	1	1-2	2	3	5
Totals	4-5	7-8	13-14	19-20	24-25

These figures assume straightforward service with hatches in a canteen serving main meals, without any complications of site, type of service, etc.

Some guidance in estimating how these complications will affect staff requirements is afforded by the following hints.

For waitress service for members of the office staff one waitress is needed for every 12 to 16 covers.

Structural difficulties may make it necessary to employ additional labour. For example, if the kitchen and dining-room have to be placed on different floors, two women or juveniles might be needed to work a service lift.

Tea service, if on a large scale disproportionate to main meal service, will call for additional staff, and this will vary with the speed required and the time available. As some indication, a girl using a teapot can pour a maximum of 200 cups in ten minutes. A double-spouted teapot would speed-up this rate and, an urn of modern construction would be still more efficient. Sometimes part-time labour can be obtained for unskilled jobs of this kind, or factory cleaners can be drafted into the canteen to lend a hand.

In a special category are the manageress, on whose experience and judgment and competence so much of the success of the canteen depends, and the cook, scarcely less important a functionary. Both of these grades of canteen staff are even more rare than when Saki uttered his bon mot about the good cook. The Ministry of Labour has started a training scheme for canteen manageresses and cooks with the object of increasing the supply. Besides training new applicants the Ministry encourages firms running canteens to send their own catering employees for training or up-grading at a Ministry training centre.

12. *Are members of my administrative and clerical staffs entitled to eat in the canteen and share facilities for providing rationed foods?*

The first purpose of the Factories (Canteens) Order is to make sure that workers doing heavy work in an essential industry get food to supplement their ration, but the policy is interpreted in a tolerant way. This tolerance makes for simplicity of administering the food allocations, and it also reflects a desire on the part of the Ministries concerned not to exclude minority groups of workers, whether doing light manual work or sedentary work, from the benefits of canteen feeding.

If a firm organises its canteen in such a way that a separate kitchen is provided for its clerical staff canteen it would have to apply for registration of the canteen as an ordinary catering establishment. As such, it would be entitled to food allocations on the basis of one-half that of the A class canteen and two-thirds of the B class canteen. If, on the other hand, the same kitchen is used for all grades of labour, there would be no objection to the clerical staff being given precisely the same facilities, and they would receive the same per caput allocation of food. It is true that the allocation for the first month's operation would be based on the firm's return of the number of factory workers, excluding clerks and managers; but the allocation in each future month would be based on the actual number of meals served in the previous month.

Perhaps it might be desirable that the Ministries of Labour and Food should regularise the position by a clear statement of the position of clerical workers under the Order (which defines the canteen as a place " where hot meals can be purchased by *persons employed at the factory* "). It is certainly desirable that the employer should scrupulously ensure that the clerical workers enjoy no facilities denied to the manual workers if he wants the canteen to run without friction.

13. *My labour force is a small one, hardly justifying a separate canteen. Should I join with neighbouring firms to run a common canteen?*

The idea seems sound, and it is sometimes put into practice. One example is known where the arrangement works with smoothness and to the satisfaction of managements and workpeople. Others have broken down from the friction generated. All sorts of practical difficulties arise in connection with providing accommodation, payment of labour, and the sharing of other responsibilities; and these may, lacking complete understanding and goodwill, waste a lot of time in discussion between managements. Generally speaking, the better course is for the managements of neighbouring small factories to get together to press the local authority to set up a British Restaurant in their locality. The local Factory Inspector and the Welfare Officer attached to the local Ministry of Labour office would be valuable allies in bringing this pressure to bear.

Special cases may exist, of course, in which the advantages of co-operation are strong. For example, a factory with a high proportion of night-shift workers might with advantage make use of the equipment of a neighbouring factory doing no night work.

14. *There are reasons which make it impossible for me to put in a full-scale canteen with cooking facilities. Is there anything I could do in a less ambitious way to see that the workpeople get at least light meals at work?*

If you decide to serve packed meals your canteen will nevertheless be graded under categories A or B by the Ministry of Food, and it will be entitled to receive the supplementary rations, but these vary somewhat from those granted to an ordinary canteen, consisting generally of larger individual allowances of a smaller variety of foods.

Category B canteens serving packed meals receive the following allowances: Butter, margarine, and cooking fats, ½ oz. per meal; sugar, ½ oz. per hot beverage; cheese, ½ oz. per meal; and preserves, ⅜ oz. per meal. The priority supplies of non-rationed foods are also available to such canteens. The meat allowance is made up into meat pies, sausage rolls, etc., by a local manufacturer nominated by the canteen.

An alternative method of feeding where no cooking facilities can be provided is the container service provided by British Restaurants, and the meal service schemes (such as the Londoners' Meal Service) run by local authorities.

15. *Where can I get advice on canteen installation and management?*

When the Ministries of Food and Labour launched their policy of encouraging factory feeding, Factory Canteen Advisers were attached to the Factory Inspector's office in sixteen regions. They are competent to advise on every aspect of the subject, from the choice of the site to the organisation of a trolley service for teas.

The Industrial Welfare Society (14, Hobart Place, London, S.W.1) has also done a good deal of work on canteen feeding, much of which is embodied in its publication "Canteens in Industry" (price 2s. 6d.).

The publication covers the whole subject most comprehensively, and, besides the aspects of the matter which have been considered in the foregoing questions and answers, deals with the legal aspect of canteen management, layouts, accounts, furnishing and decoration. A Canteen Advisory Service is maintained by the Industrial Welfare Society.

A wartime effort of the tea industry is the National Catering Service (Regent House, 89, Kingsway, London, W.C.2), which offers its advice to industrialists.

The National Society of Caterers to Industry has already been mentioned, and is an obvious channel for putting employers into touch with the great fund of experience and information in the possession of catering firms which have specialised in canteen feeding.

Information of canteen management, with particular reference to staff and service, is also given by the Good Housekeeping Institute (28-30, Grosvenor Gardens, London, S.W.1).

At a meeting organised by the Nutrition Society on May 30, several papers were delivered on "Problems of Collective Feeding in Wartime," and these papers should be consulted on dietetic aspects of the subject. A summary of them appeared in *Nature* (1942, 3790, p. 685).

Of the publications on the subject, "Canteens at Work" (by C. G. Gardiner, London, 1941; 4s. 6d.) is a valuable manual for canteen managers, and particularly interesting for its advice on accounts and the details of efficient management.

Other useful publications are: "Hints on Catering for Civil Defence Service Canteens," published for the London County Council; "Community Feeding in War Time," prepared by the Women's Voluntary Service; and "Canteen Catering," issued by the Ministry of Food.

For details of the standardisation of type of cooking appliances the reader is referred to the recent publication by the Ministry of Works and Buildings: "Cooking Appliances Schedule of Types for Wartime Supply," and Appendices A, B and C, revised edition, March, 1942 (H.M.S.O.).

The Food Research of Tomorrow

EVERY new development in the art of processing, storing, or preparing food must be scrutinised in the light of the accumulated knowledge of nutrition. Every old process must be studied eventually to develop whether it can be tolerated in face of these new facts. The science of nutrition is young, but it is a means of preventing the arts of civilisation from injuring the very people who are sometimes said to be most civilised.

Research in nutrition and the other biological sciences has the same relationship to health that research in the physical sciences bears to the physical conveniences of our modern life.

While food research will follow the trend of man's interest toward good nutrition, it will not neglect supply, sanitation, and palatability, and there will be many new discoveries that will aid in food production and food storage.

The incentive to satisfy the wishes of the consumer will still guide researchers to study factors affecting palatability; also studies to further improve sanitation. But each change must now be measured by the yardstick of nutrition.

The research of tomorrow in food industry, as in all other industries, will primarily concern itself with practical problems; it will require the use of the knowledge of the laws of nature to accomplish practical results. The discovery and enunciation of these laws of nature belong primarily in the hands of institutions where research is endowed and supported for the purpose.

There are several great agencies of research, each having a very proper place. These are:

1. Privately endowed institutions and universities.
2. State universities and experimental stations.
3. Federal Government research laboratories and experimental stations.
4. Industrial research laboratories.

These are placed in this particular order for two reasons. In the first place, they line up in this order because of the type of research for which they must, in each case, accept responsibility.

The privately endowed institution usually has more freedom and, therefore, may apply its talent and facilities to more fundamental problems without regard to application of results.

The industrial laboratories, on the other end of the list, are usually an integral part of an organisation set up to make a profit for its shareholders by performing a public good. These laboratories must, therefore, apply themselves to the solution of practical problems. This does not mean that the institutional research programmes are never capable of solving a practical problem; they do bring forth practical solutions in many instances. It does not mean that the industrial laboratories undertake no fundamental investigation; there have been many fundamental contributions from the scientists in industry. The difference lies in the field for which each organisation must feel a particular responsibility.

The State university and the Federal Government research laboratories are midway between these two

extremes in freedom of action and responsibility for practical results.

The second reason for placing these research agencies in this particular order is related to the financial support which each receives. In the past much of our research has occurred in endowed institutions. There are now some who fear that political economy of the future will not be conducive to adequate support of the endowed institutions.

In industry the picture is different. Industry has a growing realisation that research pays dividends. Industrial research certainly will grow in the future. Again, the State and Federal laboratories seem to be midway between these two extremes.

Industrial research, if it is to grow and continue to be increasingly profitable, must take the facts from the various branches of science and fit them together to get a positive answer. In fundamental research a negative answer is sometimes as valuable as a positive, but in industrial research the thing must work or it is no good. To get this positive answer the men in industry must have a fundamental knowledge which can best be learned in an institution with greater freedom from the pressure of practical problems.

The Nutrition Foundation is blazing a new trail. It has the freedom of the endowed institution, and we believe will continue to merit the support of industry. If industry is really awake to the value of fundamental research, then we can ill afford to allow changes in political economy to dry up the sources of knowledge which we depend upon for progress in the application of science to industrial problems.

The purpose of the Nutrition Foundation is to underwrite research to benefit mankind without prejudice or favour to the industry from which it derives its support. To create a co-operative organisation for such a purpose from the current earnings of industry is indeed a new step in the progress of democracy.

Abstract of a paper read by Dr. Roy C. Newton before the Board of Trustees, the Nutrition Foundation, Chicago, Ill., U.S.A.

New Swedish Yeast

A NEW substitute for extract of meat will appear on the market before long consisting of yeast produced from sulphite lye. The Svartvik sulphite mill near Sundsvall has for six months been experimenting with this new kind of yeast albumen. The trials have been entirely successful, it is stated, and it is expected that in three months a factory will be completed, which will be jointly run by the Cellulose Combine and Svenska Jaestfabriksaktiebolaget. The trial plant is at present producing several kilograms an hour. The estimated capacity of the new plant will be between 10,000 and 20,000 tons of dry yeast a year.

The kinds of sugar which can be transformed into alcohol are first extracted from the sulphite lye. Previously, the lye was then run into the sea as a waste product or perhaps used to bind dust on the roads, but by the new method pentoses are fermented, a process that results in the new kind of yeast, a white solid mass of about the same consistency as ordinary yeast for baking. Before the yeast can be used as food it is heated to 100° C. in order to kill the fermentation bacilli.

In addition to the manufacture of yeast in connection with the manufacture of sulphite spirit, the Svartvik mill has made trials for the production of the yeast *torula*. Two separate factories will be built, it is stated, in order to exploit the methods of producing torula yeast, which, like the yeast obtained in producing alcohol, contains about 50 per cent. albumen, most of which can be digested by man.

Trials have been made with the new kinds of yeast albumen in food, and they have been found suitable for mixing with soups, sauces, etc.

Food Investigation

The latest volume of abstracts from the literature of food investigation contains evidence of continued activity in research work.

As perhaps is natural in the circumstances, the number of abstracts of papers on dairy products is far and away greater than on any other subject. Pasteurisation accounts for a large number of references, and it is evident that the spoilage and putrefaction and the biochemistry of milk have been studied intensively during the last few years. A large number of papers on methods of analysis have been published and much attention has been paid to the phosphatase test.

The literature of dehydration is still sparse. On meat-drying there is only one abstract, which refers to the effect of heat on the availability of the iron of beef muscle. An abstract from a paper on dried egg albumen is of interest. The removal of dextrose from albumen before drying ensures stability of colour and solubility when the product is stored at ordinary temperatures. The papers on dried vegetables are mainly concerned with vitamin C retention.

There are a few useful references to the cold storage of fats and oils and their durability under storage conditions. The only reference to the canning of meat is a paper, published in the U.S.S.R., on the composition of canned meat.

The canning of fruits and vegetables has been the subject of a number of papers, among which may be noted one by T. P. Hoar, T. M. Morris and W. B. Adam on " The Influence of the Steel-Base Composition on the Rate of Formation of Hydrogen-Swells in Canned Fruit Tinplate Containers ". This is part 2 of a series of papers, in which the packing of Czar plums in double-lacquered cans and of white cherries, gooseberries, Pershore plums and prunes in plain cans was carried out.

In the Engineering Section are some interesting references to the control of temperature and humidity and also insulation and heat leakage, and under " Miscellaneous " are given some methods of analysis from foreign sources.

The Index is as usual a very useful summary of food research.

Index to the Literature of Food Investigation, Vol. XIV, No. 1. June, 1942. Compiled by Agnes Elisabeth Glennie, B.Sc., and Catherine Alexander, B.Sc., 1942. 4s. 6d. net.

Agar-agar Manufacture

E. J. FERGUSON WOOD, B.A., M.Sc., A.A.C.I.

PRIOR to the war, Japan produced from about 2,000,000 to 4,000,000 lb. of agar-agar by primitive means, and the price varied from 3s. per lb. upwards, inversely as the severity of the winter. America had an industry which is reported to have produced 300 tons per annum, though this figure has not been confirmed. Russia had a steadily expanding production of agar and agaroids, but was not self-supporting in this respect. America imported about 300 tons per annum, Britain about 200 tons, Australia 70 tons, and New Zealand 15 tons. The present price of agar is 25s. per lb., or $4·25, and stocks are being depleted.

The Australian Industry

One Australian firm is producing its own requirements for meat canning, one firm is close to production on a commercial scale, and two firms are engaged in laboratory experiments. All these are in Sydney, but there has been some interest shown by firms in Western Australia and Queensland. No dried agar has yet been produced for a rather clamorous local market.

The Raw Material

Although several seaweeds have been found suitable for agar-agar production, notably *Gracilaria confervoides, G. lichenoides, G. furcellata*, and *Euchyeuma spinosum, G. confervoides* is the most abundant and will probably be the main one used. This weed grows on sandy flats in about 15 to 20 feet of water, and a bed may be anything up to 2 feet deep.

The total possible production of agar in Australia cannot be assessed, but local estimates may result from noting the effect of harvesting and the amount of seaweed which a given area will yield in a year with organized collection of seaweed.

Tests are being made in order to see whether it is possible to plant gracilaria in suitable areas. The results will be important, as, if successful, they will allow the effect of harvesting to be determined.

Drying the Material

Drying tests on harvested material show that the weed can be most easily dried on wire racks, but evidence tends to show that bleaching is easiest on grass. Artificial drying was not particularly successful. The weed was dried in a warm kiln with natural draught, and in a tunnel drier with fan draught and partial recirculation. Both took 24 hours, and a similar quantity dried in air took 48 hours. The artificially dried weed had less moisture at completion of drying, but after 24 hours' exposure to the atmosphere the moisture content of all samples was the same. Artificial bleaching with chlorine was effective, but reduced the gel strength of the agar.

Natural bleaching by sun, rain, and dew gives a very desirable product, but seriously increases the cost of preparation. In laboratory scale experiments, 2 days were required to dry the seaweed and 16 days for bleaching. The weed has to be spread thinly (not more than an inch in depth) and turned at least every second day. This means a large drying-ground and actually more labour than harvesting and drying. As the resultant agar from dark weed is not particularly dark in colour at the gel strengths used, it is considered that bleaching is unnecessary in war-time. Bacteriological agar might be filtered with carbon, but even this is not obligatory, as it has been shown that growth factors, etc., present in agar are removed by excessive purification. Although golden-yellow or greenish in colour when dry, unless bleached with carbon, Australian agar gives a more transparent gel than Japanese agar and appears more elastic, though dry Japanese agar is white. In view of these facts and of the labour shortage, buyers should be content with the golden agar, which is much more easily produced under our conditions.

Cost of Agar

The price paid for the raw material has varied from £25 to £75 per ton. The latter price is encouraging to collectors and should still allow manufacturers a good margin of profit even if agar falls to half its present value, as is possible when production is moderately large. As the industry grows the price of the raw material will no doubt stabilise itself, and it must be recognised that after the war it will probably fall to about £40 per ton. If the agar is bleached by activated carbon prior to filtration, it may be found possible to lower the cost of collection still further and produce a high-grade product. In this way it should be possible to compete on the world market at the pre-war price of agar.

The Manufacturing Process

The process described is that which has been found to give best results both in laboratory scale and pilot plant experiments. Manufacturers will naturally adapt the process to suit their own requirements and the plant available.

1. The weed is sampled as follows: Small representative samples are taken and placed on white paper. The sand and other inorganic matter are shaken out and weighed. Next, other seaweeds are removed and weighed and the amount of inorganic and organic impurities is calculated, the moisture content of the gracilaria is determined, and the seaweed is extracted three times for 2 hours with live steam, 10 grammes of weed being heated at 95° to 98° C. with 250 ml. of water. Aliquots are taken from each extraction and added while still warm to a fivefold volume of alcohol. The precipitate is filtered through a tared filter and weighed, and the per cent. pure agar calculated. Alcohol is a precipitant for agar. The laboratory can thus indicate the quality of the seaweed and the probable yield of agar.

2. The seaweed is washed with beaters for 10 minutes to 30 minutes to remove sand and other impurities, and

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is then cut up in a mincer or chaff-cutter and transferred to the cookers. A counter-current or diffusion battery system of cookers is recommended, and live steam should be used to cook the weed at a temperature of 95° to 98° C. The seaweed should be in proportion of not more than 4 per cent. to the water used, otherwise boiling and filtration troubles will be encountered. The *p*H should be adjusted to 5·0 to 6·0 and kept in this region. Usually 2 to 4 hours will suffice for extraction, but this depends on the efficiency of the boiling plant. Longer times tend to produce partial hydrolysis and a decreased yield.

3. The hot liquor should then be run through a centrifuge of high sludge capacity or with continuous sludge removal. This removes very efficiently the liquor adhering to the solids and is the easiest method of removing the solids from the liquor. Unfortunately, suitable centrifuges are difficult to get, and steam-heated bag filters or other means may have to be used. Some success has followed the use of wire baskets with fine gauze screens on the inside. The weed is placed in these baskets in the vat and, after boiling, the liquor is run off from the vat itself.

From the centrifuge the liquor is run into a steam-jacketed or coil-heated tank, and (preferably) activated carbon added and allowed to act. The agar liquor is then cleared by a plate and frame press with the addition of filter aid. A brilliant and colourless liquor should result. This will contain 1·0 to 1·5 per cent. agar and may be concentrated at low temperature *in vacuo*. Care must be taken, as overheating will cause hydrolysis and resulting loss of agar.

4. The liquor is allowed to set as a gel either in ice cans or in slabs, and is frozen either in brine or in air as equipment permits. Low temperatures cause homogeneous freezing, which is undesirable. A useful temperature is 21° F., where freezing is effective and reasonably rapid. The purpose of freezing is to remove organic impurities which cannot be removed in other ways. It is found that the gel strength increases 4 to 6 times and that this increase cannot be obtained without freezing unless other more expensive methods are used.

5. The agar-ice is thawed out in water at about 35° C. and washed in running water. It can be crushed first in an ice crusher or else chopped up after thawing, when it separates as a crêpe-rubber-like mass.

6. This agar can be dried in various ways. In the laboratory a tunnel drier has been used at 45° to 50° C., but drum drying is practised on an analogous product in Russia. Spray drying has been suggested, and there seems to be no reason why it should not work. It would give a powdered agar, which is much desired.

Yields Obtained

It can be reckoned that 1 ton of dried dark gracilaria will be produced from 7 tons of wet drained seaweed, and 1 ton of clear bleached gracilaria from 8 tons of wet drained seaweed. Under present harvesting conditions one man can harvest, dry, and bleach the equivalent of about 1 cwt. of dry bleached weed per day. On many days he may be unable to harvest, but it will pay to collect and dry seaweed in the season and bleach it, if required, in the off-season.

Stored gracilaria, if properly baled, will occupy about the same space as an equal weight of wool, or probably slightly more.

The weed is boiled in 4 per cent. solution, and the yield may be computed conservatively at 33 per cent. Therefore 1 ton of agar will require the boiling of 3 tons of seaweed and 75 tons of water for the first boiling, and 50 tons for a second boiling (if a second extraction is made). Each boiling would be from 2 to 3 hours. The vats would need to hold about 15,000 gallons of water in all.

The centrifuges would have to deal with 15,000 gallons per day with 2 tons of sludge. The filters and evaporators would also have to carry 15,000 gallons, and this might be reduced to 10,000 gallons for freezing, or 50 tons of material to be frozen.

The frozen agar may be regarded as a 10 per cent. solution—*i.e.*, 90 per cent. water to be removed. Spray or drum drying would require to remove nearly 98 per cent. water. The sale price of powdered agar is always considerably higher than strip or flake agar, and powdering would remove the disability of the colour of Australian agar, as powdered agar is always brownish.

The Product

As indicated above, Australian agar is different in colour unless bleached with carbon, and, whatever the method used in manufacture, will be different in form from Japanese agar. It has still wider differences in properties. Its elasticity is somewhat greater, and its gel strength appears to be greater at higher concentrations, and less at lower concentrations than Japanese agar. The gel produced is more transparent than that of Japanese agar; syneresis seems relatively greater, resulting in a more slimy feel. Australian agar gives an excellent gel in canned meats, rather preferable to that of Japanese agar, and is also very suitable for confectionery and for bacteriological media. This information is from firms using agar of their own manufacture for commercial production, and in the case of bacteriological agar from results obtained by Professor Ward and Dr. H. L. Jensen, of the Bacteriology Department, University of Sydney, by the bacteriologist of a firm making milk products, and by the author.

Conclusions

There is, at the moment, an urgent demand for several hundred tons of agar. Australia is in a position to make a considerable contribution to this shortage, and should, at least, supply the essential needs of the United Nations. With the development of the industry as a war measure, and with the prices obtainable for agar, it should be possible to write off the capital cost and to be in a position to continue economical production after the war. This estimate of the position is made on the basis of existing methods. Short cuts, improvements, and new methods should further decrease the cost of production, while the dependence of an unsaturated market on a single source of supply (Japan) will cease. It will be to the interest of agar users to keep the Australian industry in being to offset shortages due to poor seaweed growth or to mild winters in Japan and to break the Japanese monopoly of the market. The fact that Australian agar is not inferior, and for some purposes is superior, to Japanese agar seems to ensure a future for the industry.

The possible size of the industry cannot be estimated until production stimulates a search for suitable seaweeds, but it is known that a reasonable amount can be produced from sources close to Sydney, and there is no reason to believe that these sources represent the total material available.

Food Analysis

PROGRESS IN 1942

Part II

D. W. GROVER, B.Sc., A.I.C.

Indication of Spoilage

DETERMINATION of volatile fatty acids has already proved to be a useful indication of spoilage. By close control of the conditions of distillation, Hillig and Knudson are able to analyse mixtures of formic, acetic, propionic, *n*-butyric and iso-butyric acids.[19] Their method depends upon the collection of four fractions of the distillate. Each of the acids is characterised by the proportion of the total collected in each fraction. Formic acid is estimated independently and the others algebraically from the titrations of the four fractions. Of interest in connection with the examination of smoked meat is the estimation of phenols absorbed during processing. A recently published method involves extraction with dilute alcohol, condensation with 2·6 dichloroquinonechlorimide to form a blue indophenol dye, which is extracted with *n*-butyl alcohol and determined photometrically.

Sugars, Starches, Gums, etc.

The separation and identification of sugars by means of their derivatives has been extended by two series of papers in the *Journal of the American Chemical Society*. Hurd, Ligget and Gordan make use of fractional distillation of the propionyl derivatives and succeed in separating mono-, di-, and tri-saccharides with an error of 1 to 4 per cent.[26] Coleman, Farnham and Miller separate the azoyl derivatives by chromatographic analysis.[27] They have measured the physical constants of these compounds and suggest that they should be useful for identifying the sugars. A new series of photographs of the osazones of the principal sugars has been published.[28]

Jackson and McDonald of the U.S. Bureau of Standards have made a careful study of the optical rotation of invert sugar, dextrose and levulose in sugar concentrations of 5 to 32 gms./100 c.c.[29] The Clerget double polarisation has generally superseded other methods of determining sucrose. Recently the polarimetric estimation of sucrose by means of the destruction of reducing sugars by heating with an alkaline reagent has been revived. One investigator[30] claims to obtain results which compare well with the Clerget procedure.

Titration of Reducing Sugars

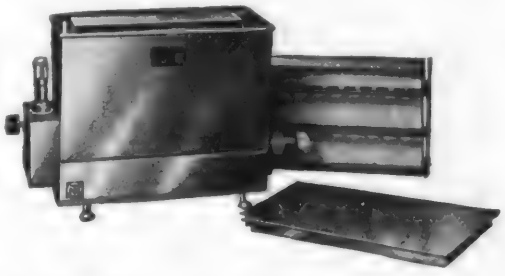
A slight modification of the widely used Lane and Eynon titration for reducing sugars consists of adding a known volume of the unknown to 20 c.c. of Fehling's solution and completing the reduction by titrating while boiling with a standard invert sugar solution. This procedure, for which tables are published, may have advantages in some circumstances.[21] A series of papers dealing with the determination of water in glucose syrup, sugar syrup, etc., defines the conditions required for accurate results.[22] Glucose, for instance, is successfully dried on calcined and washed filter cel in vacuum at either 38° or 100° C. For other materials, filter paper is used as spreading agent.

The chemical constitution of Fehling's solution is the subject of an interesting paper by Gaskin.[23] By examining the polarisation of various mixtures of copper sulphate, alkali tartrate and sodium hydroxide, the existence under some conditions of co-ordination compounds of the type $CuT.2Cu(OH)_2$ associated with one or two molecules of alkali tartrate is indicated. In Fehling's solution, which is strongly alkaline, the whole of the copper is in the form of cupric hydroxide held in solution by the tartrate present. It is suggested that replacement of tartrate by some other stabilising agent (*e.g.*, mannitol) would reduce the effect of dilution on the oxidising power of the reagent.

Papain is one more of the growing list of reagents available for the identification of gums. An acid solution gives a precipitate with some gums but not with others. The precipitates differ in appearance and in the effect of salts. Precipitation is not due to enzyme action.[24]

Fermentation Products

It is possible to calculate extract and alcohol of wines from the specific gravity and refractive index, but the formulæ previously available have not been applicable to sweet wines of the port type. New formulæ derived by Fischl[35] do not suffer from this disadvantage, wines with from 3 to 20 per cent. extract and 10 to 25 per cent. alcohol agreeing within about 0·5 per cent. with the true values. Errors liable to occur in the determination of alcohol by distillation are discussed by Cartwright.[36] He concludes that the most important are measurement of sample, temperature control and determination of the specific gravity of the distillate. If it is convenient to work at some temperature other than the standard, the results can be corrected by the use of a new table of corrections. For determining the *p*H of matured whisky both the glass and quinhydrone electrodes are suitable, a correction



Bath for Reductase test by Townson and Mercer.

of +0·37 being applied to the latter. For raw whisky and gin, the absence of buffering substances causes difficulties and only the glass electrode is accurate.[37]

An interesting discussion of methods of analysis and evaluation of fermentation products is published in the *J.A.O.A.C.*[38] The subject-matter covered includes the diastatic activity of malt, the proteolytic activity of malt, estimation of trace metals in beers, sulphur dioxide in beer and wine, methyl alcohol in spirits and the evaluation of hops.

Work on Vinegars

Earlier work of Edwards and Nanji had shown that vinegars of different types—brewed, spirit and artificial—can be distinguished by the nature of the volatile reducing substances present. Further experience with these tests, the most important of which are the oxidation value, iodine value, bisulphite-combining substances, is described by Whitmarsh.[39] The last of these tests is a new one and is a measure of the carbonyl groups. The presence of acetyl methyl carbinol in spirit vinegars is demonstrated, a result contrary to several statements in the literature. The distinctive volatile reducing substance in spirit vinegar is ethyl alcohol, which is characterised by its oxidation value and absence of iodine value and bisulphite-combining substances. Malt vinegar, on the other hand, is characterised by the presence of both ethyl alcohol and acetyl methyl carbinol, the latter causing the iodine and bisulphite values to be high.

Flavours

A method of determining dulcin in foods described by Longwell and Bass,[40] depends on hydrolysis of the sweetening agent to *p*-phenetidine by boiling with 4N sulphuric acid for four hours. The amine is then separated by steam distillation, diazotised and coupled with phenol in alkaline solution, the resulting dye being estimated colorimetrically. Sugar interferes, and, if it is present, the dulcin must be extracted with ethyl acetate.

Refinements in the technique of sublimation enable the quantitative separation of saccharin from benzoic acid, vanillin and dulcin.[41] The food is extracted in the usual way and the extract sublimed in a Hortvet sublimator, when saccharin sublimes at 145° to 155° C., benzoic acid at 45° to 55°, vanillin at below 65° and dulcin at above 173°. The saccharin may be estimated by weight or titration.

Rapid and apparently accurate analysis of vanilla extracts for vanillin is achieved by precipitation of the dinitrophenylhydrazone, which is collected on a Gooch crucible and weighed.[42] Dilution of the extract, together with some dilute hydrochloric acid followed by filtration, is the only preliminary treatment required.

Essential Oils

Peppermint oil is the subject of an interesting review by Baldinger.[43] Analytical methods and figures are considered mainly in relation to the U.S. Pharmacopœia. Methods for the estimation of menthone and resins and a useful bibliography are included.

Several modifications of methods for the rapid determination of alcohols in essential oils by reaction of the sample with a known excess of acetic anhydride were reviewed last year. Substitution by acetyl chloride is now suggested, the principal advantage being a more rapid reaction.[44] Two titrations are necessary, first of the evolved hydrochloric acid and then of the chloride ion, as pinene present (in peppermint oil) neutralises some of the acid.

Preservatives

Errors in the estimation of sulphur dioxide in onions have arisen owing to interference of volatile sulphur compounds natural to that vegetable. These are eliminated if a modification of Parke's test is used for the determination.[45] For this test the sample is steam-distilled into a vessel containing iodine and barium chloride solutions. Owing to the rapid evaporation of the iodine from the receiver there is little chance of oxidation of less volatile sulphur compounds. Using this procedure, onions and pickles known to be free from sulphur dioxide were found to give figures of not more than an apparent 0·5 p.p.m. of this preservative.

Although the use of monochloracetic acid in foods has not been sanctioned either here or in the United States, it has been fairly widely recommended as a preservative or "stabiliser" for use in beverages. A method of detection and estimation is therefore opportune.[46] Extraction of the beverage with ether after acidulation with sulphuric acid gives quantitative recovery. For estimation, the ethereal solution is rendered alkaline with caustic soda, freed from ether by distillation, at the same time hydrolising the monochloracetic acid, and analysed for chloride, using Volhard's method.

Trace Elements

1942 has seen the publication of the usual large number of papers dealing with the determination of trace elements in foods and biological material. The present extent of this subject may be gathered from a bibliography published in the *Analyst*,[47] which contains several hundreds of references.

Dithizone is used for the estimation of lead and other metals, the favoured procedure being the mixed colour technique, in which the colour produced by the reaction of a standard amount of dithizone with the unknown is matched by adding a standard solution of the metal to a similar quantity of dithizone. For this method to be successful all the dithizone must be extracted into the solvent in which the matching is done. A study of this extraction[48] has shown that it is incomplete if the *p*H is above 8. Of the salts used to keep the heavy metals in solution at a *p*H suitable for extraction of the dithizone, cyanide/citrate mixture was found to be the least satisfactory compared with acetate, tartrate or cyanide alone. Dithizone extraction direct from aqueous solutions of sugar products in the presence of potassium cyanide has been found to give satisfactory figures for traces of lead.[49]

Further experience has been gained in the estimation of copper, using diethyl dithiocarbamate.[50, 51, 52] Preliminary extraction with dithizone is not effective in causing complete separation from iron and the effect of the latter is suppressed by the presence of bipyridine. Bismuth is removed from the dithizone extract by shaking with potassium iodide.

Traces of iron cannot readily be estimated as thiocyanate with a photoelectric photometer, as the coloured compound does not give reliable readings. The coloured complex formed by iron with *o*-phenan-

throline does not suffer from this disadvantage. Aluminium and pyrophosphate are liable to interfere with the colour development, but this can be overcome by proper attention to detail.[53]

Tin may be estimated conveniently and fairly rapidly by a method based on a combination of distillation as stannic bromide and colorimetric determination of its dithiol complex.[54] The distillation takes place at 220° C. from sulphuric and hydrobromic acids.

Modifications in Arsenic Tests

Modifications of well-known tests provide two interesting methods for arsenic. One described as a rapid sorting test is based on that of Reinsch.[55] As little as 0·001 mg. as the trioxide can be detected and rather larger quantities determined. The other depends on arsine evolution, as for the Gutzeit test, but the final measurement is made with a photoelectric photometer, the arsenic being present as arsenomolybdate. Arsine is absorbed in a dilute iodine solution buffered with sodium bicarbonate. Addition of sulphuric acid, sodium molybdate and a metabisulphite to reduce excess of iodine completes the preparation of the solution. No special steps need to be taken to ensure steady evolution of the arsine as is the case for the Gutzeit method.[56]

For the routine determination of trace metals the spectograph has much to recommend it. Harper and Strafford[57] describe a rapid standard technique, sensitive to 0·5 p.p.m. The sample is wet-oxidised and the metals precipitated as sulphides, together with cadmium, which acts both as a carrier and a spectrographic internal standard. The mixed sulphides are collected on a graphite filter bed and arced between graphite electrodes.

War Gases

The aspiration test for mustard gas recommended by the Chemical Defence Research Division, Ministry of Supply, does not give any information concerning the amount of contaminant present. It is a limit test indicating whether or not the sample is fit for human consumption. A chemist who may, for instance, have to blend slightly contaminated stocks will require a quantitative estimation such as that described by Lockwood.[58] The sample is extracted with petroleum ether to dissolve the mustard gas, which is then partitioned between the petrol and a mixture of acetic acid and water under fixed conditions, so that exactly 50 per cent. of the total is transferred to the acid fraction. The latter is titrated with standard iodoplatinate until a permanent pink colour indicates complete reaction of the mustard gas. The method has been applied to a study of the rate of disappearance of mustard gas from food of various kinds.

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Packaging for Army Rations

AN article entitled " Containers for Army Rations and the Problems they Present ", by Captain Robert R. Melson, Q.M.C. of the Chicago Quartermaster Depôt, U.S.A., is an appeal from an expert to other experts.*

The first knows exactly what he wants army packages to do, and he has not found any that will do it entirely satisfactorily; the second are given the performance specification and are asked to get on with the necessary research work and deliver the goods.

Captain Melson's needs are not moderate. Packaging for the army's rations must withstand temperatures from 20° below zero to 130° F. or higher. Shipping cases of food may be unloaded from ships into a surf or on wet beaches and allowed to stand from one night to the next, at which times they may be subjected to tropical rains. Subsistence stores are subject to being transferred several times, and the handling usually will be rough. Packaging materials must withstand the high humidities of the tropics without absorbing moisture and losing their rigidity or tensile strength, having the seams open, or without transferring an excessive amount of moisture-vapour. Infestation by insects and damage by rats must be avoided.

The Quartermaster Corps is called upon to have huge supplies of foods in readiness at all times, which necessitates long storage periods in tropical areas awaiting the eventuality of operations in that area. Therefore, the army's food is required to be packaged so that it will stand the tropical climates for at least a year.

Commercial v. Army Packaging

The difference between commercial and army packaging is clearly indicated. In commercial practice (says Captain Melson) products are packaged in such a way that only a very small percentage of failures occur. The percentage of failures is commonly reduced to a point where it is more economical to accept the failures than to increase the packaging costs to a point where perfect protection is provided. This is not true of army packaging.

As a rule where the conditions are most severe the food supply is of the greatest importance. For instance, in a difficult landing operation, where the greatest extremes in packaging and packing are required, the food supply is of paramount importance. Although only a small percentage of the total is used in this manner, if it continually failed the total effort would be greatly jeopardised. In other words, that small percentage, which in civilian life is permitted to spoil under severe conditions, in army life is most important.

Shipping Cases

First of all, Captain Melson wants shipping cases. He wants a fibre box which is equivalent to a wooden one. He does not care about its construction or composition; he only cares about its performance in overseas operations. He asks the paper industry for a substitute for wooden boxes which is as strong, is tougher, and is as resistant to water and high humidities as a nailed wooden box. He asks the industry: " What have you got to offer?"

Another type of shipping case must stand submersion in water for 60 hours without leaking. But it is not as simple as that. It must be equally watertight after it has been shipped several thousand miles. As a test to imitate the effects of this it should receive twenty-five or fifty falls in a seven-foot drum before making the submersion test.

Three different materials were tried for sealing a watertight shipping case, but fresh ideas are asked for.

First, weatherboard solid fibre cases and cases embodying asphalt barriers have been sealed with asphalt, and the closures and manufacturers' joints sealed with asphalt. These cases were watertight but involved use of hot asphalt and considerable labour.

The second trials were with cases lined with sisalkraft. These were sealed by means of waterproof tape and hot asphalt. Here again the cases were watertight but the methods too laborious.

A third method was to dip the sealed case in wax at high temperature and then to carry out another dipping at a lower temperature. This sealed carton was then placed inside a wooden box. This is required to protect the corners of the waxed cases from damage.

Protection from Vapour

The Quartermaster Corps' Subsistence Laboratory (continues Captain Melson) has several applications for moisture-vapour-resistant packages to hold such products as soluble coffee, lemon powder, dehydrated vegetables, dehydrated soups, powdered milk, powdered eggs, flour, cereals, dessert powders, and numerous other items. Some of these items have been previously packed in metal for export. These products require a high degree of protection from moisture-vapour. The best packaging films available are none too good.

At present a package for dehydrated white potatoes, sweet potatoes, beets, and rutabagas is specified which consists of an inner liner of laminated glassine, a second bag consisting of Cellophane laminated to lead foil in turn laminated to asphalt impregnated kraft, which is inserted in a solid fibre carton. Two such units are then placed in a wooden box. This packaging is considered satisfactory as designed. However, it is felt that there is room for improvement, and there are a great many other products which could be adapted to flexible packaging materials.

The majority of the films available for their moisture-vapour transfer rate have been tested. Re-tests of these films or merely a new combination of the old films are not being asked for. What is wanted is a new material or a substantial improvement on the old one which will stand head and shoulders above the films commonly used today. The men who generate the new films are asked to produce a product that will meet these severe requirements.

Preventing Insect Infestation

There is a search for protection for flours, cereals, dehydrated fruits and other materials from tropical insect infestation. At this date only metal cans, glass containers, and barrels are proof against this plague.

* Published in *The Canner*.

What are wanted are packaging films or materials which will give a high degree of protection against infestation. This is a problem for the pulp and paper industry to solve, if their products are to gain favour for export purposes.

There is also the problem today of packaging dried fruits. These fruits must be packaged in a liner which will withstand a very high moisture content without being adversely affected. In this liner must be further packaging which will prevent the transfer of moisture either in or out of the package. One of the chief problems of dried-fruit packaging for shipment to warm climates is protection from infestation. At present there is no satisfactory method of preventing this without the use of metal.

The packaging of dried fruit is also closely associated with its processing. Hot-pack fruits are filled in the cartons when hot. This in a measure will pasteurise the interior packaging material. However, the packaging material must, in turn, be able to withstand a temperature of 160° F. Present plans call for either filling the fruit into a multi-wall bag which lines a fibre carton or of filling a glassine-lined carton, sealing it, and placing this inside a protective bag. There are no specifications on packaging dried fruit in flexible packaging materials, although they are being considered now.

Watertight and water-resistant papers are of interest at the moment. There may be a call for such a product at any moment. Effectively sealing such papers on a production line is a challenge to industry.

Fibre-bodied Cans

Many items are now being packaged in fibre-bodied cans in lieu of metal. The Quartermaster Corps has specifications covering four types of fibre cans. The bodies of these cans consist of several layers of asphalt between asphalt-impregnated kraft papers. The can liners are varied, depending on the products to be packed. Although these cans are quite good, there is still room for improvement in the moisture-vapour-protectiveness of the body, and especially the tightness of the seams on the ends.

Combating the Rat

In any area occupied by a large number of people, with many of them eating in the open, with garbage disposal difficult, and the attention of those concerned on other subjects, rats will be a plague. Therefore it is desirable, if possible, to employ shipping cases which are proof against rats. This problem is very difficult to solve. Any good suggestion will be welcome, concludes Captain Melson. The information and suggestions which he gives in his article should constitute a useful guide for those concerned with the technical side of packaging research.

The Meat Flavour

MAX SALOMON

MEAT FLAVOUR cannot be described in the same terms as, for instance, the flavour of oranges or the aroma of cocoa. There is actually nothing definite about it, because it appears only after certain manipulations of the meat and varies according to the kind of those manipulations and the amount of fat present.

Raw meat, in its fresh state, has no particular flavour; and it is by frying, roasting, braising that we get the " roasted meat " taste, partly derived from the heated or overheated fat, but when half a pound of minced beef or veal is boiled in a closed vessel with one and a half pints of water for an hour there emerges the subtle, delicate and indescribable meat flavour.

Degradation of the Proteins

Lean beef or veal, free from visible fat, consists of 70 to 75 per cent. water, 20 to 25 per cent. protein, 2 to 4 per cent. fat, and 1·2 to 1·5 per cent. ash.

By heating raw meat with water the proteins coagulate, and by increased and continued heat they begin to disintegrate into cleavage products—through the proteases and peptones, peptides, to the amino-acids.

Animal as well as vegetable proteins liberate, according to their constitution, about twenty different amino-acids, some amides, etc., but only a few of these amino-acids are the originators of the " meat flavour ", the foremost being glutamic acid. Among other amino-acids and amides with a similar but not so pronounced meat flavour are prolin, aspartic acid, asparagine, arginine and cystine.

It might seem that one of the most likely sources of glutamic acid would be meat extract, but this product is expensive and it contains only about 15 per cent. of glutamic acid, and in some cases less, according to the method of manufacture.

Seeds of all kinds, after the removal of fats and oils; cereals, after removal of the carbohydrates, are sources of proteins.

In America, where corn starch is made in very large amounts from maize, there remains the protein zein as a by-product; in the oilcake from soya beans used as cattle fodder there remains a high percentage of glycinin. The two proteins contain about 30 per cent. and 20 per cent. of glutamic acid respectively.

Treatment of Protein Material

These proteins are treated under pressure in autoclaves with diluted hydrochloric acid and hydrolysed to their amino-acids. After this treatment some of the glutamic acid will separate as hydrochloride, and the rest of it may be obtained as the calcium salt. Both the glutamic acid hydrochloride and the calcium glutamate are then refined, transformed into their sodium salt and sold as monosodium glutamate. The remainder of the hydrolysate is neutralised by sodium carbonate, filtered and evaporated to a thick paste, and can still be sold as a cheap flavouring for savoury food products. If it is not desired to isolate the glutamic acid, the whole hydrolysate is neutralised, filtered and evaporated, to be sold as " vegetable extract ".

On the Continent even cheaper and more easily obtainable protein-containing substances are hydrolysed for making extracts and meat flavours. Among these are horn meal, oilcakes of all kinds, technical caseinogen, etc. All of them contain glutamic acid up to 20 per cent.

Brewer's Yeast

Another source of glutamate is yeast, and here we are only concerned with the so-called "brewer's yeast", a by-product of the brewing industry. The idea of making use of the high protein content of brewer's yeast is not new; fifty years ago the first experiments were made to obtain a yeast extract which could replace meat extracts, at that time very expensive products.

Yeast contains the so-called nucleoprotein; by hydrolysis it yields amino-acids with a good percentage of arginine, lysine, tyrosine, leucin, prolin, etc., but less glutamic acid. Purine and pyrimidine bases, as well as phosphoric acid and a carbohydrate (ribose), are further products. The purine and pyrimidine bases are of no flavour value.

One of the disadvantages of using brewer's yeast is the persistence of the bitter flavour coming from the hops used in the making of beer. To remove this bitterness the yeast must be thoroughly washed with a very dilute solution of sodium carbonate, which in its turn must be removed by washing with water. The purified yeast is subsequently passed through filter-presses or centrifuged.

Autolysis of Yeast

A later alternative to the acid hydrolysis of yeast is a biological process—autolysis or self-digestion by enzymes. The yeast is liquefied by the action of its enzymes, sometimes with the addition of small quantities of an acid or salt. The cell walls of the yeast break; the split-up protein contents are set free and the liquid extract is separated from the cell walls by centrifuging or filtering and finally evaporated in vacuum until a stiff paste is obtained. The chief advantages of this process are the full retention of the valuable vitamins of the B group and the improvement in flavour.

Both the vegetable protein hydrolysate commercially called "Vegetable Extract" and the "Yeast Extract" (either acid hydrolysate or autolysate) are used as meat-flavouring agents, but are different in flavour. The former is reminiscent of the natural gravy from braised beef and the latter of a natural veal broth, so that a mixture of both will give a satisfactory meat flavour for all purposes. Some manufacturers of these extracts try, more or less successfully, to enhance the flavour of these extracts by adding concentrated juice of carrots, parsnips or other vegetables or infusion of Borage, Lovage, Fenugreek, etc. These combinations are closely guarded trade secrets.

Between the nutritional value of all these extracts there is not much difference, the average analysis of vegetable extracts being:

35-42 per cent. protein, in the form of its cleavage products.
39-42 per cent. sodium chloride and other mineral salts.
20-23 per cent. moisture.

They contain no vitamins.

An average analysis of yeast extracts prepared by autolysis is:

38-45 per cent. protein, in the form of its cleavage products, including purine and pyrimidine bases.
8-12 per cent. carbohydrates.
15-17 per cent. mineral matter, mostly phosphates and sodium chloride.
25-30 per cent. moisture.

They are rich in vitamin B_1, riboflavin, and contain some nicotinic acid.

Digestibility of Protein Hydrolysates

The value of the vegetable protein hydrolysates and yeast extracts lies also in another field. Under wartime conditions the available diet is not too rich in proteins, but is predominantly starchy. The nutritional value of proteins depends on two factors: digestibility—the proportion of amino-acids which will be absorbed into the blood stream; and assimilability—the extent to which the amino-acids are able to provide for elaboration into tissue protein.

The hydrolysed vegetable and yeast proteins are already in a state of easier digestibility than ordinary proteins which are taken with food, as meat, eggs, cheese and milk, and do not need so much work by the enzymes of the alimentary canal. But the digestibility and assimilability of the proteins and their cleavage products depend to a large extent on the nature of the other constituents of the diet, and the best results are attained when they are combined with vegetables. This is an interesting and important interrelationship between the basic-reacting foods, such as vegetables and fruits, and the proteins.

Yeast extracts made by autolysis and carefully evaporated and concentrated *in vacuo* are of special physiological value by reason of the presence of vitamins of the B group, glutathione and ergosterol, the mother substance of vitamin D.

Meat Substitutes

Through the rationing of meat the demand for "meat substitutes" has made their manufacture profitable. These substitutes aim to replace minced meat in rissoles and other meat dishes. So far as the author's investigations have gone, these consist mainly of cereal products such as bread-crumbs, rusk, etc., soaked in a solution of vegetable or yeast extract or sodium glutamate and dried again. They mostly contain between 2 and 3 per cent. of these extracts, together with some spices. They are soaked with two or three times their weight of water and sometimes mixed with minced meat, hashed corned beef, etc., or mashed potatoes and cereals and fried or cooked.

When no meat is mixed with them their nutritional value is very low, and the fried, cooked or baked rissoles, savoury rolls, etc., contain only a small fraction of 1 per cent. of amino-acids. There is no objection to these substitutes, when sold under a proper description, for extending minced meat or other meat dishes, because, quite apart from nutritional value of the vegetable and yeast extracts, they have very definite digestive properties. A foodstuff prepared with them may be more appetising and the flow of gastric juices considerably increased, thereby aiding the better digestion of monotonous wartime meals.

Ministry of Food

Latest Statutory Rules and Orders

The list given below is the continuation of the list of Orders published in *Food Manufacture*, February 1, page 56.

PRICE FIXATION ORDERS

No.	*Date.* 1942.	
1650	Aug. 15.	Fruit Pulp (Control and Maximum Prices) Order. Revokes S.R. & O. 1941 Nos. 814 and 1377.
1651	,, 15.	Amending the Egg Products (Control and Maximum Prices) Order, 1942.
1657	,, 18.	Amending the Green Onions (Maximum Prices) Order, 1942.
1669	,, 20.	Feeding Stuffs (Maximum Prices.) Revokes S.R. & O. 1941 No. 1872 and 1942 Nos. 6, 365, 586, 1219 and 1462.
1670	,, 19.	Amending the Flour and Flour Mixtures (Current Prices) Order, 1942.
1675	,, 21.	Amending the Pickles and Sauces (Control and Maximum Prices) Order, 1942.
1709	,, 26.	Amending the Plums (Maximum Prices) Order, 1942.
1729	,, 28.	Amending the Soft Fruit (Maximum Prices) Order, 1942.
1732	,, 28.	Amending the Game Birds (Maximum Prices) Order, 1942.
1752	,, 29.	Amending the Home-Grown Wheat (Control and Prices) (Great Britain) Order, 1942.
1755	,, 29.	Amending the Hay (Control and Maximum Prices) Order, 1942.
1757	,, 29.	Amending the General Licence, July 16, 1942, under the Bread (Control and Maximum Prices) Order, 1941, as amended.
1773	,, 31.	General Licence, under the Saccharin (Control and Maximum Prices) Order, 1941.
1774	,, 31.	Onions (Maximum Prices).
1801	Sept. 2.	Amending the Eggs (Control and Prices) (Great Britain) Order, 1942.
1845	,, 10.	Kitchen Waste (No. 2) Order.
1878	,, 15.	Directions, under the Oats (Control and Prices) (Great Britain) Order, 1942.
1884	,, 16.	Macaroni and Similar Products (Control and Maximum Prices) Order.
1900	,, 17.	Pears (Maximum Prices).
1910	,, 17.	Fish (Maximum Prices) (No. 2) Order. Revokes S.R. & O. 1942 Nos. 4 and 585.
1912	,, 18.	Prescribing an Appointed Day for the purposes of the Venison (Control and Maximum Prices) Order, 1942.
1915	,, 18.	Amending the Plums (Maximum Prices) Order, 1942.
1916	,, 18.	Amending the Bread (Control and Maximum Prices) Order, 1941, and the General Licence thereunder, July 16, 1942.
1917	Sept. 18.	Amending the Flour (Control and Prices) Order, 1941, and the Flour and Flour Mixtures (Current Prices) Order, 1942.
1932	,, 22.	Directions, under the Bread (Control and Maximum Prices) Order, 1941, and the Flour (Restriction on Use) Order, 1942.
1957	,, 23.	Amending the Dripping (Maximum Prices) Order, 1940.
1958	,, 23.	Amending the Technical Tallows and Greases (Home Melt) (Maximum Prices) Order, 1941.
1980	,, 26.	Home-Grown Rye (Control and Maximum Prices) (Northern Ireland) Order. Revokes S.R. & O. 1940 No. 1440 and 1942 No. 1393 as respects Northern Ireland.
2014	,, 30.	Amending the Cereal Breakfast Foods (Control and Maximum Prices) Order, 1941.
2015	,, 30.	Potatoes (1942 Crop) (Control and Prices) (No. 2) Order, 1942. Revokes S.R. & O. 1942 Nos. 1498 and 1956.
2016	,, 30.	Milk (Maximum Prices) (England and Wales) Order, 1942. Revokes S.R. & O. 1940 Nos. 1393 and 2029, and 1941 No. 1936 so far as they relate to England and Wales.
2032	,, 30.	Fish Sales (Charges) (No. 2) Order.
2059	Oct. 3.	Amending the Fruit Pulp (Control and Maximum Prices) Order, 1942.
2060	,, 3.	Amending the Milk Powder (Maximum Prices) Order, 1941.
2070	,, 5.	Amending the Oranges (Maximum Prices) Order, 1942.
2076	,, 7.	Amending the Egg Products (Control and Maximum Prices) Order, 1942.
2103	,, 9.	Cake and Flour Confectionery (Control and Maximum Prices) Order, 1942.
2120	,, 14.	Flour (Maximum Retail Prices) Order.
2147	,, 17.	Amending the Bacon (Prices) Order, 1941.
2148	,, 17.	Citric Acid (Control and Maximum Prices) Order.
2161	,, 21.	Amending the Home-Grown Apples (Maximum Prices) Order, 1942, as amended.
2162	,, 21.	General Licence, under the Onions (Maximum Prices) Order, 1942.
2179	,, 22.	Amending the Milk (Maximum Prices) (England and Wales) Order, 1942.
2231	,, 29.	Amending the Cereal Breakfast Foods (Control and Maximum Prices) Order, 1941.

No.	*Date* 1942.	
2232.	Oct. 29.	Amending the Macaroni and Similar Products (Control and Maximum Prices) Order, 1942.
2248	,, 31.	Amending the Carrots (1942 Crop) (Control and Prices) Order, 1942.
2272	Nov. 4.	Amending the Home-Grown Rye (Control and Maximum Prices) (Great Britain) Order, 1942, the Home-Grown Wheat (Control and Prices) (Great Britain) Order, 1942, and the Home-Grown Dredge Corn (Control and Prices) (Great Britain) Order, 1942.

FEEDING STUFFS

2127	Oct. 15.	Order, amending the Feeding Stuffs (Maximum Prices) Order, 1942.
2253	Nov. 2.	Directions, under the Feeding Stuffs (Rationing) Order, 1942.
2258	,, 3.	Order, amending the Feeding Stuffs (Regulation of Manufacture) Order, 1942.
2403	,, 24.	Order in Council, amending Regulation 52 of, and adding Regulations 28B, 55E, 60CA and 60P to, the Defence (General) Regulations, 1939. (Interference with water, pipes, etc., used for fire fighting; Sale of Controlled Articles in execution of diligence in Scotland; Powers by order to regulate certain matters for purposes of Fertilisers and Feeding Stuffs Act, 1926; Church door notices dispensed with.)

GENERAL

1671	Aug. 20.	Amending the Food Control Committees (Constitution) Order, 1939.
1683	,, 22.	General Licence, under the Food Control Committee (Local Distribution) Order, 1939.
1730	,, 28.	Amending the Food Control Committees (Licensing of Establishments) Order, 1941.
1731	,, 28.	Amending the Food Control Committees (Local Distribution) Order, 1939, and granting a General Licence thereunder.
1751	,, 28.	Food Control Committees (Constitution) Order. Revokes S.R. & O. 1939 Nos. 1019, 1105 and 1498, 1940 Nos. 9 and 788, and 1942 No. 1671, as from January 1, 1943.
1831	,, 5.	Amending the Meals in Establishments Order, 1942.
1837	Sept. 8.	Amending the Acquisition of Food (Excessive Quantities) Order, 1942.
1863	,, 12.	(Control) Order.
1956	,, 23.	Amending the Potatoes (1942 Crop) (Control and Prices) Order, 1942.
1963	,, 24.	Pre-Packing of Butter (Control) Order.

ONIONS

2069	Oct. 5.	Home-Grown Onions (Distribution) Order, 1942.

No.	*Date.* 1942.	POTATOES
2247	Oct. 31.	Potatoes (1942 Crop) (Charges) Order. [Emergency Powers (Defence) Act, 1939. S.2.]

POINTS RATIONING

2345.	Nov. 13.	General Licence, under the Food (Points Rationing) (No. 2) Order, 1942, and the Rationing (General Provisions) Order, 1942. (Certain pudding mixture.)
2347	,, 14.	Amending the Food (Points Rationing) (No. 2) Order, 1942.
2335	,, 12.	General Licence. ("Butterkist.")

RESTRICTION ON DEALINGS

2188	Oct. 24.	Amending the Food (Restriction on Dealings) Order, 1941, and prescribing an Appointed Day thereunder.
2189	,, 24.	General Licence. Revokes S.R. & O. 1941 Nos. 1415 and 1580; and 1942 No. 561.

SAMPLING

2451	Nov. 30.	Amending the Sampling of Food Order, 1942.

SOFT DRINKS

2118	Oct. 13.	Soft Drinks (Marking of Containers) Order.
2133	,, 16.	Soft Drinks (Returnable Containers) Order.
2348	Nov. 14.	Amending the Soft Drinks (Licensing and Control) Order, 1942, and the Soft Drinks (Current Prices) Order, 1942.

TOMATOES

2205	Oct. 27.	Order, revoking the Home-Grown Tomatoes (Distribution) Order, 1942, and the Home-Grown Tomatoes (Distribution) (No. 2) Order, 1942, and amending the Home-Grown Tomatoes (Maximum Prices) Order, 1942. Revokes S.R. & O. 1942 Nos. 1054, 1107 and 1647.

TRANSPORT

2057	Oct. 3.	Directions (Apples).
2125	,, 15.	Directions (Barley).
2240	,, 30.	Order, amending the Directions May 11, 1942. (Bread.)
2058	,, 3.	Directions (Plums).
2204	,, 26.	Order, amending the Food (Sector Scheme) Directions, August 18, 1942. (Cocoa and Chocolate.)
2415	Nov. 25.	Directions (Bread).
2378	,, 19.	Order, amending the Directions, April 4, 1942. (Potatoes.)

VEGETABLES

2329	Nov. 11.	Canned Vegetables (Prohibition of Retail Sales) Order.

News from the Industry

Flavouring and Culinary Essences

The Ministry of Food requires returns of past trading from all manufacturers of flavouring and culinary essences, for the purpose of allocating supplies of raw materials, and has requested the British Essence Manufacturers' Association to collect data both from its members and non-members.

Manufacturers who are not members of the Association are therefore requested, in their own interest, to send in their names to Mr. J. W. Middlemiss, the London Chamber of Commerce, 69, Cannon Street, London, E.C.4, who is acting for the B.E.M.A. in this matter and who will send them all necessary particulars.

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Changes in Divisional Food Organisation

The Minister of Food has approved the following changes in the Divisional Food Organisation:

Mr. E. L. Rabone, M.C., J.P., who has rendered valuable service to the Ministry as Divisional Food Officer, Midland Division, has found it impossible to continue in that appointment owing to pressure of outside business, and has been succeeded by Lieut.-Colonel F. C. C. Balfour, C.I.E., C.B.E., M.C.

Lieut-Colonel Balfour served in the Ministry as Director of Sugar Distribution and as Chairman of the Sugar Advisory Committee, and later as Director of Starch.

* * *

Resignation of Director of Canned Meats

Mr. W. T. Curtis, who throughout most of the period of control has been Director of Canned Meats in the Ministry of Food, has found it necessary to resume certain duties with his firm. He has accordingly, as from February 1, 1943, relinquished his position as Director of Canned Meats, but has undertaken, for a few months, to continue to assist the Ministry in the capacity of Adviser on Canned Meats.

Sugar Cane Research

Research now being carried out at the British West Indies Central Sugar Cane Breeding Station in Barbados has resulted in such high-yielding, new varieties of sugar-cane that a reduction in the acreage under sugar-cane may be possible without curtailing the output of sugar. This will release land for the cultivation of other food crops.

* * *

Mr. J. T. Stewart

Mr. J. T. Stewart, N.D.A., N.D.D., who has been Head of the Bread and Yeast Branch of the Ministry of Food since January, 1941, has been appointed an Assistant Director for Bread. It is an indication of the importance which the Ministry attaches to the transport problems facing the industry that Mr. Stewart will give special attention to these.

* * *

Sugar Beet Delivery Bonus

It has been decided to extend to sugar beet delivered to the British Sugar Corporation during the current campaign the arrangement embodied in the Sugar Beet Contract for 1943, by which a graduated late delivery bonus will be paid to growers in respect of beet required to be delivered after December 31. The bonus for each ton will be as follows (delivery dates being in parentheses): 1s. 8d. (between January 1 and 14); 3s. 4d. (between January 15 and 28); 5s. (between January 29 and February 11); 6s. 8d. beet delivered thereafter. Payment of the bonus will be conditional on the grower having fulfilled his delivery permits during the normal campaign period (October-December).

* * *

Irish Sugar Beet Prices

Irish growers will receive £4 per ton for next harvest's sugar beet crop. The price of sugar to the consumer will also be increased.

Use of White Flour in Bread Making

It is evident from enquiries received at the Ministry of Food that certain bread bakers are under the impression that in deciding the amount of white flour which they may add to National flour in bread making, they must take into account any white flour which may have been blended into the National flour at the mill before delivery. This is not so. All National flour supplied to a baker may be assumed to conform to the requirements of the Flour Order, 1943, and to it the proportion of white flour prescribed by the Minister of Food may be added by bakers for use in bread making. This is not more than one part of white to every seven parts of National, or, in making batch bread in Scotland, not more than one part of white to three parts of National.

* * *

Effect of Phosphorus Bombs on Foodstuffs

The possible effect of phosphorus incendiary bombs on foodstuffs has now been investigated. In general, foodstuffs which have only been exposed to the fumes arising from these bombs will be safe to eat, since the oxidation products of phosphorus are non-toxic. It may be, however, that that food will be sufficiently close to a bomb for particles of phosphorus thrown out from the bomb to have become imbedded. In such a case, the foodstuff will have to be destroyed. Obviously, then, it will only be in the case of foodstuffs which are in close proximity to the bomb, and not in that of those which come within the area of visible cloud that there will be any danger of serious contamination. It is, however, quite possible that foods in the immediate vicinity of a bomb might be rendered unpalatable by the fumes produced from the burning oil or even by droplets of the oil itself. This type of contamination could only be detected by testing and examining the food carefully.

Fats for Vegetarians and Orthodox Jews

Vegetarians and orthodox Jews who have surrendered their bacon rations will, on application to the Food Office, be allowed from February 7 to purchase from the retailer where they are registered for fats an additional 2 ozs. of vegetable margarine a week.

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Dehydrated Food Experiments

Laboratory demonstrations showing the potential value of dehydrated foods were seen by Mr. Thomas Johnston, M.P., Secretary of State for Scotland, and Mrs. Johnston, when they re-recently visited the Hannah Dairy Research Institute at Ayr. Mr. Johnston, in a brief address, indicated that dehydration of foodstuffs had not only a wartime value in saving space, but might prove of great use in dealing with post-war production surpluses and gluts. Meats, vegetables, fish and milk were the products treated in the Hannah Institute laboratory. The company, who were welcomed by Professor E. P. Cathcart, Vice-Chairman, and Dr. Norman Wright, Director, in the absence of Principal Sir Hector Hetherington, Chairman of the Council of the Hannah Institute, tasted samples of food dehydrated and afterwards reconstituted. A description of the processes, some still in their experimental stage, was given by Sir Joseph Barcroft, who is Chairman of the Food Investigation Board, under the auspices of which modern dehydration methods have been largely developed.

* * *

Fuel Supplies to Industrial Consumers

The Ministry of Fuel and Power reminds all industrial consumers, and prospective consumers, of fuel that they must not change from one class of fuel to another, or install new fuel burning plant, without having first ascertained that the fuel will be available.

As all types of fuel are in urgent demand, changes may embarrass the general fuel supply position and lead to wasted expenditure of materials and skilled labour. If a change is considered essential, consumers will be advised individually by the Ministry of Fuel and Power. The only exception is for the conversion of oil-burning plant to use creosote pitch. The Petroleum Board has been authorised by the Ministry of Fuel and Power to arrange such conversions.

If a consumer needs to install new fuel-burning plant, or *himself* feels that the conversion of his plant from one fuel to another is desirable, he should, if he is engaged upon work for one of the Production Ministries (*i.e.*, Admiralty, Ministry of Supply or Ministry of Aircraft Production), approach the Ministry principally interested in his production, which will in turn approach the Ministry of Fuel and Power. If he is not engaged upon work for one of these Ministries, he should approach the Division of the Ministry of Fuel and Power responsible for the fuel he intends to use—*i.e.*,

1. *The Regional Services Director of the Ministry for the Region,* in the case of *coal* or *coke.*
2. *The Petroleum Division of the Ministry, Dean Stanley Street, London, S.W.* 1, in the case of *liquid fuel* (whether petroleum, creosote or creosote/pitch mixture).
3. *The Gas and Electricity Division of the Ministry, New Oxford House, Bloomsbury Way, London, W.C.* 1, in the case of *gas.*
4. *The Coal Tar Control, Quebec House, Quebec Street, Leeds,* in the case of *coal tar or any coal tar product other than creosote or creosote/pitch mixture.*

The only exception is in the case of electricity, where the *Electricity Commission* should be approached, *through the local electricity supply undertaking.*

The consumer will then receive advice in the light of local fuel supply conditions and any other relevant circumstances.

* * *

Thistles for Viennese

From a thistle plant grown in the rubbish dumps of the Vienna municipality of Bruckhausen, the Germans have wrung edible oil and protein.

The stalks and leaves—which contain raw fibre—are used to produce cellulose, says the *Volkischer Beobachter.*

More Pork for Britain

The possibility of increased pork supplies for Britain is seen in an announcement that the Food Distribution Administration has purchased about 50,000,000 lbs. of pork meat products and more than 13,000,000 lbs. of lard during December.—*Reuter.*

* * *

More Canned Soup for Lend-Lease

The War Production Board at Washington has issued an amended Conservation Order permitting the packing of approximately 4,000,000 additional cases of canned soups for Lend-Lease, the armed forces and civilians during 1943.—*Reuter.*

* * *

U.S. Grass Expert for Britain

Professor D. B. Johnstone-Wallace, Cornell University Agrostologist, is to try and help Britain to increase her food production.

He has been granted leave of absence to become principal scientific officer and head of the Agricultural Department of the National Institute for Research in Agricultural Engineering at Askham Bryan (Yorks).

He will deal with the development of mechanical processes in boosting food production, including grass silage for livestock, the dehydration of grasses and vegetables, and the establishment of new productive pastures.

His wife and daughter, who will accompany him, have volunteered for war work in England.—*Reuter.*

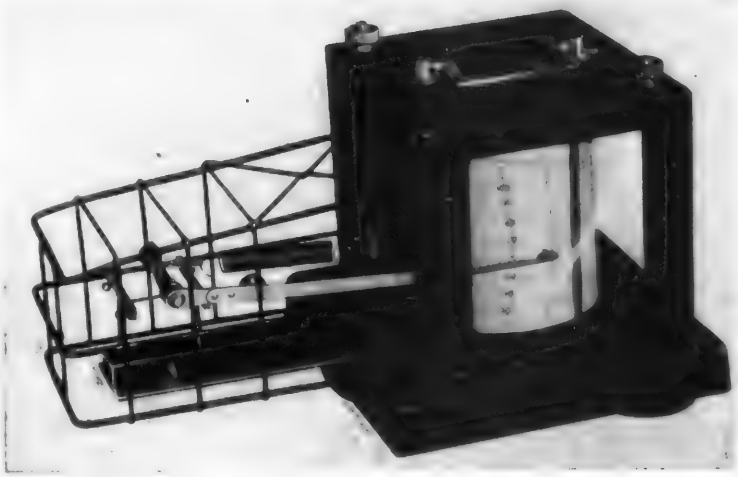
* * *

Reconstituted Milk

Reconstituted milk that is "indistinguishable from fresh milk in appearance, taste and chemical content" has been demonstrated to the New York Academy of Medicine by Dr. C. E. North.

His process, which he has been perfecting for twenty-five years, is to separate and dehydrate the butterfat and skim milk at different temperatures.

Both dehydrates will keep for at least ten years in sterile containers. They can be mixed in any desired proportions to make skim milk, whole milk, light or heavy cream, butter, ice cream and buttermilk.—*Reuter.*



Sternol, Limited

In refreshing contrast to the labour troubles of the last two decades was the interesting little ceremony which occurred at the London works of Sternol, Ltd., the lubricating oil firm, just before the Christmas holiday, when the Managing Director, on behalf of the company, presented long service certificates to men who had been in the company's employ for twenty years and upwards.

Each recipient, in addition to a framed certificate signed by the Chairman and the Managing Director, received an extra monetary gift and a grant of a permanent addition to his standard wages.

The chief foreman, on behalf of the men, expressed appreciation of the company's action and thanked the Managing Director for personally attending the ceremony, at the same time congratulating him on the fact of his having completed a fifty-years' connection with the company.

* * *

Change of Name and Address

Foodettia, Ltd., advise that they have changed their name to *Willards Foods, Ltd.*, and their address to Ash Street, Gosforth, Newcastle-upon-Tyne, 3.

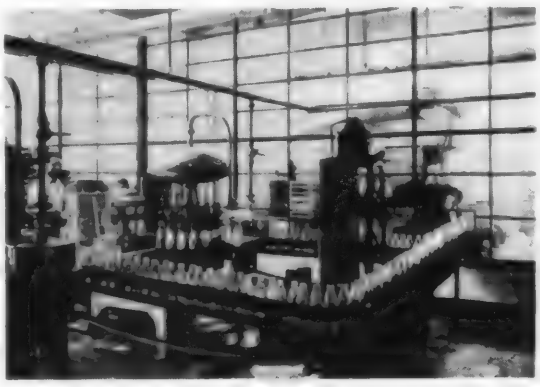
Willards Foods, Ltd., will be exactly the same company and will take over all agreements, contracts, and guarantees made by Foodettia, Ltd.

State Bakery

A giant State bakery to supply the entire bread needs of the capital is now being built on the outskirts of Teheran.

All privately owned bakeries in Teheran will be abolished when the State bakery is in full operation, and private bakers will in future act merely as distributors for the State bread. The main object of the scheme is to obviate adulteration and profiteering by private interests and to ensure equitable distribution.—*Reuter.*

* * *



Crompton Parkinson Appointments

Mr. Albert Parkinson, M.B.E., Joint Managing Director, has been appointed Deputy Chairman of Crompton Parkinson, Ltd., and Mr. E. C. Holroyde has been appointed a Joint Managing Director.

Temperature Recorders

A series of temperature recorders, operating on a somewhat novel principle, and suitable for industrial or laboratory use where it is desired to secure a permanent time and temperature record, have recently been developed by Sunvic Controls, Ltd.

In the Sunvic ambient temperature recorder the conventional bimetal helix is replaced by a pair of bimetal strips supporting a floating differential roller, to which the pointer arm and pen is attached. The illustration shows this mechanism, which, as will be seen, involves no bearings at all. In addition, the recorder-drum is accurately machined so as to be concentric and co-axial with the shaft. Moreover, by an adjustment provided on the supporting platform, the pen-arm can be brought accurately parallel to the drum. Thus, the pen pressure can be reduced to a minimum without fear of the pen leaving the chart. As a result of these features, friction and consequent sticking are almost entirely eliminated.

An important feature of these recorders is their rapidity of response, which approaches that of a mercury thermometer.

* * *

Modern Metal Windows

The metal window is particularly valuable for all types of modern food factories, in which light and cleanliness are outstanding features. A good example is the new ultra-modern creamery of Ross's Dairies, Ltd. All the windows of this creamery are of the metal type, being purpose made, of the "Reliance" section pattern, by Williams and Williams, Ltd.

The fact that one of the great advantages of the metal window is minimum light obstruction is illustrated in striking fashion by this creamery, with large areas of interior glass and metal screens

dividing one department from another, giving a degree of light everywhere which not so long ago would have been regarded as impossible. The reason is the great strength of the metal window, so that the amount of actual metal required for given conditions is relatively small, while windows of this type are an engineering job, made to extremely accurate dimensions, and never warp, twist or otherwise alter in shape.

* * *

Electricity in a Beet-Sugar Factory

B. Smith has described (*J. Inst. Elec. Eng.*, 89, Pt. 2, No. 10, August, 1942) the application of electricity in the treatment of sugar beet through all the stages to the ultimate production of pure sugar. Although many factories in Great Britain have applied electricity in the best manner possible within their limited expenditure, yet both in the factory and in the laboratory there still remains much room for further improvement. For example, individual drives could be installed in many places where at present one large unit and line shafting now exist, and provided they are suitably interlocked—especially where elevators and conveyors work in conjunction—would prove a great advantage. Again, the sugar house should be equipped with the best type of sugar-spinning centrifugals. Much has been done by the manufacturers in conjunction with the users to improve this class of machinery.—*Nature.*

* * *

Marshall's Food Products, Ltd.

At a luncheon and sales conference exhibition held at the Holborn Restaurant, London, on February 12 by Marshall's Food Products, Ltd., over 100 people attended. Among outstanding lines exhibited were new offers of chocolate pudding powder, other pudding powders variously flavoured, and a new line in summer drinks tablets and bulk drink powder. Other products were Marshall's Malted Milk, Devon Brand Mustard and a custard flavour which, when added to ordinary flour, makes a custard to take the place of custard powder.

OBITER DICTA

● That this House, realising the unique value of fresh milk in the national diet, asks that His Majesty's Government should not, without the fullest enquiry, embark upon a policy involving the consumption of half-boiled milk, frequently known as pasteurised milk, which is still the subject of conflicting expert opinion. — *Sir Percy Hurd et al., Motion in the House of Commons.*

● One way to increase the use of fresh green vegetables would be to make the use of tinned and dried vegetables at the present time an offence.—*Mary B. in a letter to the "Manchester Daily Dispatch".*

● In your Agricultural Correspondent's note on the urgent matter of cleaner milk there occurs the statement: "I understand that any suggestions put forward" (by the N.F.U.) "will seek to safeguard the position not only of the many thousands of producer-retailers of milk in country districts, but of farmers delivering in urban centres." Is it pertinent to ask that "any suggestions put forward will" also "seek to safeguard" the health and the lives of millions of milk consumers? — *Lord Horder in a letter to the "Daily Telegraph".*

● We have made a rule in this Ministry not to preach sermons or to make emotional appeals to the people without at the same time giving them an opportunity for a practical realisation of what we want them to do.—*Lord Woolton.*

● Lord Woolton tells us that bread and flour will be rationed unless we reduce our consumption of these foods. It would be a help if he would let us know what our "target" should be. My family of six eat about 6 oz. of bread each a day, and we use between 3 lb. and 4 lb. of flour a week. Is this excessive? Another point: since we are urged to use potatoes instead of flour, why is potato flour now unobtainable?—*Madeleine Leslie-Smith in a letter to "The Times".*

● The Manchester Committee remind me of Alice in Wonderland. They sit down discussing fish supplies when there are none. It is silly of them. There is not sufficient fish to go round. —*Mr. J. W. Robinson, President of the Fleetwood Fish Merchants' Association.*

O.B.E. for Chemist

Mr. Sydney J. Johnstone, B.Sc., F.I.C., Principal of the Mineral Resources Department of the Imperial Institute, becomes an Officer of the Order of the British Empire (O.B.E.).

In 1903 he joined the staff of the Scientific and Technical Department of the Imperial Institute, and so commenced a life-long association with work on the investigation, development and utilisation of the mineral resources of the British Empire. After being successively head of the Institute's Mineral Investigation Laboratories and Minerals Intelligence Section, in 1937 he attained his present position as Principal of the whole Mineral Department.

On the outbreak of war he took charge of the Commodities Intelligence Section of the Ministry of Economic Warfare, which Section he had organised when hostilities seemed imminent. In this post he directed the work of over a score of technical experts, comprising geologists, mineral technologists, chemists, plant and animal product specialists, and statisticians. The Section, which was installed as a working unit of the Ministry on the first day of war, won high praise for its speedy, reliable and untiring work.

* * *

Soya-Bean Growing in France

Last year for the first time soya beans were grown on a fairly large scale in France, says the official German news agency from Paris.

OBITUARY

Sir William Arbuthnot Lane

Sir William Arbuthnot Lane, Bart., C.B., F.R.C.S., M.S., who died in London on January 16 at the age of 86, will be remembered not only as the greatest surgeon of his day, but as the man who helped to make the people diet conscious. After fifty years' surgery, realising that a great many of the surgical operations could be avoided by prevention, he embarked on a policy of teaching the public something about its food and the simple ways of health.

In 1925 he gathered together a great number of scientific and medical authorities, formed the New Health Society and its journal *New Health*, and thereby created an organisation which, through public platform, press articles and propaganda, popularised the balanced diet, the simple routine of exercise, breathing and posture.

At a time when the canning industry in this country was developing, Lane organised a committee to investigate the nutritional aspect of canning, as a result of which two reports were issued, which were completely in favour of canned foods.

Lane advocated the consumption of wholemeal bread as against white bread, a clean milk supply, encouraged irradiated milk, the consumption of fresh fruits and vegetables, as well as copious draughts of plain water.

He was undoubtedly the most popular diet expert Britain has ever known—popular in the sense that he translated into understandable language the constantly revealed facts about the nutritional value of everyday foods.

* * *

Lord Hirst of Witton

Lord Hirst, Chairman and Managing Director of The General Electric Co., Ltd., died January 22, at the age of 79, after a short illness.

One of the founders of The General Electric Co., Ltd., in 1889, he became Managing Director in 1900 and Chairman in 1910. He started his business career with the electrical industry in London at the age of 18. A well-known industrialist, whose services have been frequently utilised in the affairs of State, he served on the League of Nations Sub-Committee of "Experts for Scientific Property". He was one of the four prominent business men and experts invited to go on a Government Commission to Australia in August, 1928, to confer with the Commonwealth Government and the leaders of industry and commerce on the development of Australian resources and on other matters of economic interest to Great Britain and the Commonwealth.

A recognised authority on international trading, he served as Economic Adviser to the Cabinet

Lord Hirst of Witton

Research Committee and on many committees such as the Cabinet Trade and Employment Panel, Advisory Committee of the Board of Trade, 1922-25, 1929-32, 1936-39, as well as the Committee on Unemployment Insurance, 1925-26, and the Committee on Co-operative Selling in the Coal Industry, 1926. In addition to being a member of the Melchett-Turner Conference, he served on the Committee of Industrial Research, in which field his activities are well known. Lord Hirst was also a member of a number of industrial and research institutions connected with the electrical and its allied industries. Prior to becoming President of the Federation of British Industries, 1936-38, he had acted for some years as Chairman of the Empire Committee of that body. Among other activities, he was President of the Radio Manufacturers' Association since 1938, Hon. Member of the Institute of Electrical Engineers and Past-President of the Association of Technical Institutions, and a Past-President and one of the founders of the Institute of Fuel. He was a Past-President of the British Export Society and the British Electrical Development Association, as well as the Incorporated Society of British Advertisers and the Decimal Association.

Lord Hirst was created a baronet in 1925 and was raised to the peerage as Baron Hirst of Witton in 1934.

Always interested in charity, a few months ago he gave £20,000 to the Benevolent Fund of the I.E.E., and very shortly before his death became Chairman of an appeals committee representing all branches of electrical activities to raise funds for the Red Cross.

During the Battle of Britain he was one of the first to present a Spitfire to the R.A.F.

* * *

Ulster Damsons

Another Ulster Cinderella of the orchard has been discovered following the interesting recent revelation that of all the varieties of apples in Britain the Bramley Seedling has ten times more vitamin C than any other, states the *Belfast Telegraph*.

It is the Ulster-grown damson, large quantities of which, canned by an old-established Northern Ireland firm, formed part of the record consignment of goods recently shipped under a Ministry of Food contract for the use of the armed forces. These damsons have a particularly delicious flavour of their own, but surprising enough, in most cases, no special care is taken to cultivate them. The majority of the trees, in fact, are employed in the Armagh district to skirt the apple orchards and act merely as wind breakers for other fruit trees. Now the "wind breakers" have been found to possess a high market value.

COMPANIES

Liebig's Extract of Meat Company, Ltd.

At the seventy-eighth ordinary general meeting of Liebig's Extract of Meat Company, Ltd., Mr. Kenneth Carlisle (Chairman and Managing Director) in his statement said:

"The balance of profit, at £213,000, is practically the same as that for last year, and so long as taxation continues at the present high level there is small prospect that any marked improvement on this figure can be shown. The volume of our trade and the results have exceeded all previous bests, but, after making provision for the claims of the Revenue Authorities, the amount remaining available for distribution in the form of a tax-free dividend is strictly limited, since the canons of sound finance cannot be lightly set aside, and regard must be had to the eventual demands of deferred repairs and obsolescence.

Your directors propose, therefore, that the final dividend shall be 6s., free of income tax (making with the interim dividend a total of 8s. free of income tax), per unit of Ordinary stock.

The trade in our proprietary lines in this country, embracing the well-known brands Oxo, Lemco, Fray Bentos, Beefex, etc., is conducted under the ægis of our associated company, Oxo, Ltd., who also operate the factories in this country, and I am pleased to report that once again a most successful year's trading has been achieved, to which all members of the fine team that collaborate in guiding that company's destinies have handsomely contributed."

* * *

Rio de Janeiro Flour Mills and Granaries

At the meeting of the Rio de Janeiro Flour Mills and Granaries, Ltd., Mr. S. C. Sheppard (Chairman) said the recommended final dividend of 1s. per £1 stock, less tax, making a total dividend for the year of 8 per cent., less tax, increased the carry-forward by £2,256.

Since the last meeting Brazil had joined the United Nations in their fight against the Axis aggressors for the maintenance of freedom and tolerance throughout the world. This further action on her part more closely united Great Britain and Brazil in their cultural, political and commercial relations.

With regard to the future of Brazil, a steady and continued development was taking place in the industrialisation of that country, particularly in the districts of Rio and Sao Paulo. The exploration of their vast wealth of raw materials was now being closely studied and, once an improvement could be seen in their local transport facilities, which was having the close attention of the authorities, it should give a still greater impetus to the many developments now taking place, so that he was definitely hopeful.

China Sending Tea Bricks to Russia

About 5,000 tons of tea bricks are to be supplied to Russia this year by the State-operated China Tea Corporation under a contract signed between the Corporation and the Soviet foreign trade authorities.

The Corporation is experimenting to extract a tea essence by a scientific process which will enable a highly concentrated extract to be sent to the United States. Samples have already been sent for testing, and the Corporation hopes to go into large-scale production soon.

Russia and the United States are China's best markets for tea, but since the closing of the Burma Road there has been a big drop in exports to the United States.—*Reuter.*

* * *

American Agricultural Research

Professor J. A. Scott Watson, Agricultural Attaché to the British Embassy in Washington, referring recently to American agricultural achievements, said that the increase in food production in the United States in 1942, compared with the good performance of 1941, was enough to feed 20,000,000 extra people. That had been done without the compulsory measures that operated in this country.

The goals for 1943 had been set higher still. More meat, eggs, dairy products, etc., were aimed at, and new kinds of crops were to be grown. There was much anxiety about labour; too much of it had been withdrawn from the farms.

Referring to his visits to American agricultural colleges and experimental establishments, Professor Scott Watson said that America was unquestionably leading the world in agricultural research. Those engaged in it had great achievements to their credit in regard to soil conservation, plant breeding and animal nutrition. At one time we looked to Germany as the leader of scientific thought and research, but in future we must look across the Atlantic. We should send most of our research workers there for advanced training. We had, of course, done so in the past, but those contacts greatly needed to be developed if we were to bring the full power of science to bear on our farm problems.

* * *

Temperature Measurement

The British Standards Institution has published a comprehensive code for temperature measurement. The B.S.I. code is the first of its kind published in any country, and has involved several years of investigation by a strong committee of scientists, instrument makers and engineers. The code covers the whole range of industrial thermometry, starting with the International Temperature Scale, based mainly on the work of the National Physical Laboratory, and going through mercury thermometers, thermocouples, resistance thermometers and radiation pyrometers of all kinds. A very valuable section deals with the sources of error, and there are also several sections covering special problems of thermometry, such as the measurement of the temperature of gases and liquids and the surfaces and interiors of solids.

In the preamble, the code is stated to be of a provisional character issued for war purposes, and it will be subject to revision as soon as the situation permits. The code has been in use in a number of laboratories and works for some time past on an experimental basis, and its value has thus been thoroughly established.

Information and Advice

Fruit Cake

8,584. *Required, a recipe for as rich a type of fruit cake as possible that can be manufactured at the present time without infringing the Cake and Flour Confectionery Order and still afford the necessary profit.* (London.)

The following recipe will give the cake required, and it may be mentioned here that all recipes where the cakes produced are sold over 1s. a pound should be calculated in the manner given below to avoid infringing the new Order:

Ingredients.	*Weight.* lbs.	ozs.	*Cost.* s.	d.	*Fat.* lbs.	*Sugar.* lbs.
Cake margarine ...	5	0	2	8½	4·20	—
Neutral fat	3	0	1	7½	3·00	—
Castor sugar ...	8	0	4	2	—	8·00
Liquid egg	8	0	7	0	0·74	—
National flour ...	16	0	2	2½	0·224	0·35
Soya flour	1	0		4	0·20	0·05
Baking powder ...		6		3¾	—	—
Salt		2		¼	—	—
Liquid milk ...	8	0		8	0·004	0·264
Sultanas	8	0	4	8	—	5·12
Raisins	8	0	4	8	—	5·12
Peel	2	0	3	0	—	—
Totals	67	8	31	4½	8·368	18·904

Yield: 67 lbs. 8ozs., less 8 per cent. loss = 62 lbs. Cost per lb., 6·07d.

Total fat content	13·5 per cent.
Total sugar content	30·5 ,, ,,
Total fat and sugar content ...	44 ,, ,,

This recipe makes a very satisfactory cake which is well worth 1s. 6d. per lb.

Preparation of Tripe

8,583. *Required, details of the preparation of tripe.* (London.)

In this country the first and second stomachs of the bovine animals are used, the first being called the rumen and the second the reticulum. The latter produces the honeycomb tripe for which there appears a decided preference.

Methods of preparation are varied, but there is one thing common to them all. If a good colour is to be obtained, the preparation must be started as soon as possible after slaughter has been carried out. The contents of the stomach are first removed and the whole thoroughly washed and scrubbed with brushes, after which process the excess fat is trimmed off. A rotary-type washing machine is employed for the next part of the operation, the stomachs being placed in the machine with a small quantity of soda and fed with hot water at a temperature of between 136° and 140° F. The vanes are set in motion, and their rotation removes the mucus from the lining. The addition of the soda not only assists in this, but aids the bleaching of the tripe. On removing from the machine the lining should be carefully examined and any remaining mucus removed with a dull knife.

Next comes the cooking, the time for which will vary with the age and the condition of the animal from which the tripe is obtained. That from old cows will never really get tender however long it be boiled, but it is found that on an average three hours should be enough, provided that the cooking is steadily carried out. As a rough guide, if the heavy seams in the tripe can be penetrated easily by the finger, the tripe may be assumed to have been cooked sufficiently. The cooked tripe is transferred to a vessel of cold running water until it has been thoroughly chilled, and, if necessary, trimmed once more. The tripe is sometimes steeped in a bleaching agent to obtain the white colour so much appreciated.

Information Supplied

8,382. *Machine for slicing dates.* (Glos.)

8,384. *Information regarding plant for the manufacture of macaroni, and electrically operating machinery for the manufacture of vermicelli.* (Northumberland.)

8,391. *Suppliers of second-hand slicing machine.* (London.)

8,394. *Names of possible suppliers of material for thickening purposes in the manufacture of piccallili.* (Yorks.)

8,395. *Suppliers of onion flavouring.* (Lancs.)

8,397. *Nature of binding materials for fish cakes.* (London.)

8,417. *Information regarding firms who can supply equipment for the manufacture of citrus acid from lemons and limes, pectin from citrus pulp, plain and terpeneless citrus essential oil, orange pulp—preserved in bulk—for manufacture of orange marmalade (export purposes), citrus peels preserved in bulk, concentrated citrus juices, lime juice cordial, jams and jellies.* (India.)

8,418. *Suppliers of factory-type can openers capable of opening tins of varying shapes and sizes in large quantities.* (London.)

8,422. *Information regarding the growing of cucumbers similar to those formerly imported from Holland and suitable for pickling. Enquirer understands that these cucumbers are now being grown in this country.* (Scotland.)

8,433. *Suppliers of sterilisers used in fruit canning.* (Yorks.)

8,435. *Book giving advice on the working up and use of seaweed.* (London.)

8,438. *Suppliers of machinery for the manufacture of potato crisps.* (Lancs.)

8,467. *Suppliers of invertase.* (Yorks.)

8,469. *Manufacturers of flake machine plant, and makers of small mills capable of producing a very finely ground product. Also name of an expert in wheat products.* (Norfolk.)

Information Required

8,557. *Manufacturers of plastic bottle closures.* (Staffs)

Recent Patents

These particulars of new patents of interest to readers have been selected from the "Official Journal of Patents", and are published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

Abstracts of Recent Specifications

Improvement in and Relating to the Preservation of Food

A process for the preservation of foods, and particularly of meat, which consists in submitting the substance to be preserved, and the containers in which the same is to be packed, to heat, preferably radiant heat, in a heating chamber through which the substance and containers pass, packing the substance in the containers, applying lids thereto during their passage through the heating chamber, hermetically sealing the lids on the containers under a vacuum; and again submitting the contents of the containers to heating at a lower temperature than during the first heating, whilst under pressure less than atmospheric pressure.

Process according to the above claim, wherein when the containers have collapsible walls the second heating is carried out while the sealed containers are subjected to a vacuum.

Apparatus for carrying out the process claimed in either of the preceding claims, wherein the heating chamber is in the form of a sterilising chamber, having means for heating the interior thereof, and wherein there are comprised an endless conveyor running into and out of the interior of the upper portion of part of said chamber and feeding the substance to be preserved into the sterilising chamber adjacent to the heating means, a second conveyor carrying containers in which the heated substance is to be packed through the lower part of the heating chamber, means for packing said containers with the sterilised substance, a magazine for the lids of said containers, means for applying such lids to the packed containers, a vacuum chamber communicating with the sterilising chamber through an air lock, means for sealing the containers passing through the vacuum chamber from the sterilising chamber, and a final heating chamber in communication with the vacuum chamber through an air lock, and provided with means for heating the contents of the containers passing through the heating chamber to a temperature lower than the temperature of the sterilising chamber with a pressure in the containers less than atmospheric.

547,674. The Smithfield and Argentine Meat Company, Ltd., and Corporacion Argentina de Productores de Carnes and James Arnold Brewster.

Specifications Published

Printed copies of the full Published Specifications may be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, at the uniform price of 1s. each.

547,674. SMITHFIELD AND ARGENTINE MEAT CO., LTD., CORPORACION ARGENTINA DE PRODUCTORES DE CARNES, and BREWSTER, J. A.: Preservation of food.

547,679. SIGNODE STEEL STRAPPING CO.: Package-binding apparatus.

547,753. EVERED AND CO., LTD., and PINKESS, L. H.: Means for controlling the flow of fluids in pipes or conduits.

547,775. MALAN, L. DE M.: Implements for digging.

547,786. AKTIEBOLAGET ALKA ALUMINIUMKAPSLAR: Apparatus for capping bottles, flasks, and like containers.

547,791. SANKEY AND SONS, LTD., J., and HELDEN, W. VAN: Egg-poachers.

547,830. HOLMES, D. M.: Electric water heaters.

547,850. WINTERNITZ, L.: Boxes or containers.

547,858. AMERICAN DAIRIES, INC.: Increasing the milk yield and the quality of the milk obtained from lactating ruminants.

547,871. HUGHES, R. M. (GEIGY AKT.-GES., J. R.): Manufacture of aqueous emulsions for insecticidal purposes.

547,872. FOSTER WHEELER, LTD.: Tubulous steam and other vapour generators.

547,873. MARKESINIS, K.: Boiler and like fire and smoke tubes.

547,874. HUGHES, R. M. (GEIGY AKT.-GES., J. R.): Manufacture of insecticidal compositions and the resulting products.

547,882. VAUGHAN NOVELTY MFG. CO.: Device for peeling vegetables or fruits.

547,892. MANCHESTER OXIDE CO., LTD., CLAYTON, J. H., AND BANN, B.: Manufacture of colouring matters.

547,915. BOEHM, LTD., F., and KUNZER, H.: Process for preparing preserved egg products.

547,927. STAFFORD ALLEN AND SONS, LTD., and WEST, T. F.: Insecticidal preparations.

547,978. KLEEN, N. E. AF.: Absorption refrigerating apparatus.

547,994. JOBLING AND CO., LTD., J. A., and BOWMAKER, E. J. C.: Manufacture of laboratory and like glassware.

Trade Marks

The list of trade marks of interest to readers has been selected from the "Official Trade Marks Journal" and is published by permission of the Controller of H.M. Stationery Office. The journal can be obtained from the Patent Office, 25, Southampton Buildings, London, W.C. 2, price 1s. weekly (annual subscription £2 10s.).

JAKLAP.—619,540. Flour, confectionery (not medicated), bread, pastries, vermicelli, macaroni, spaghetti, biscuits (other than biscuits for animals); fish dressings, sausage rusk, and sausage meal prepared from cereals. **Jack Lapidus,** 17, Mount Pleasant, Cheetham, Manchester, 8; Manufacturer.

GREENGOLD.—620,085. Coffee. **Twentieth Century Coffee Corporation, Limited,** 10, West Place, London, S.W. 19; Merchants. (By consent.)

I-I-JU-LOLS.—620,090. Sweets (not medicated). **Arthur James Bufton,** "Quality Sweet Works", 975, Stratford Road, Birmingham, 28; Manufacturer.

"DURAMBER." — 620,150. Semolina. **Chelsea Food Products, Limited,** 15, Lots Road, Chelsea, London, S.W. 10; Flour Millers.

New Companies

Kingston Growers, Limited. (375887.) To carry on bus. of growers, sellers and preservers of fruit and vegetables, etc. Nom. cap.: £1,000 in £1 shares. Dirs.: To be appointed by subs. Subs.: Mabel Wilson, 6, Colenso Street, Hull (clk.); Mabel Collins, 31, Mons Street, Chanterlands Avenue, Hull (clk.).

B. Fieldsend (Caterers), Limited. (375899.) 1, High Street, Penistone, Yorks. Nom. cap.: £1,500 in £1 shares. Dirs.: Bertha Fieldsend and Elsie L. Fieldsend, both of 30, Bridge Street, Penistone, Yorks; J. Fieldsend, 51, Thurlstone Road, Penistone, Yorks.

Cecil Ward, Limited. (375901.) Chestnut House, Elm, Wisbech, Cambs. To take over the bus. of a dlr. in yeast and bakers' sundries cd. on at Elm, Wisbech, by C. Ward. Nom. cap.: £300 in £1 shares. Dirs.: C. Ward and Mabel Ward, both of Chestnut House, Elm, Wisbech.

Walter Taylor and Son (Crewe), Limited. (375938.) 42, West Street, Crewe, Ches. To take over the bus. of a baker, confectioner, grocer, etc., cd. on at Crewe as "Walter Taylor and Son". Nom. cap.: £2,000 in £1 shares. Dirs.: W. C. Taylor and Mrs. D. Taylor, both of 42, West Street, Crewe.

Taken from the Daily Register, compiled by Jordan and Sons, Limited, Company Registration Agents, 116, Chancery Lane, London, W.C. 2.